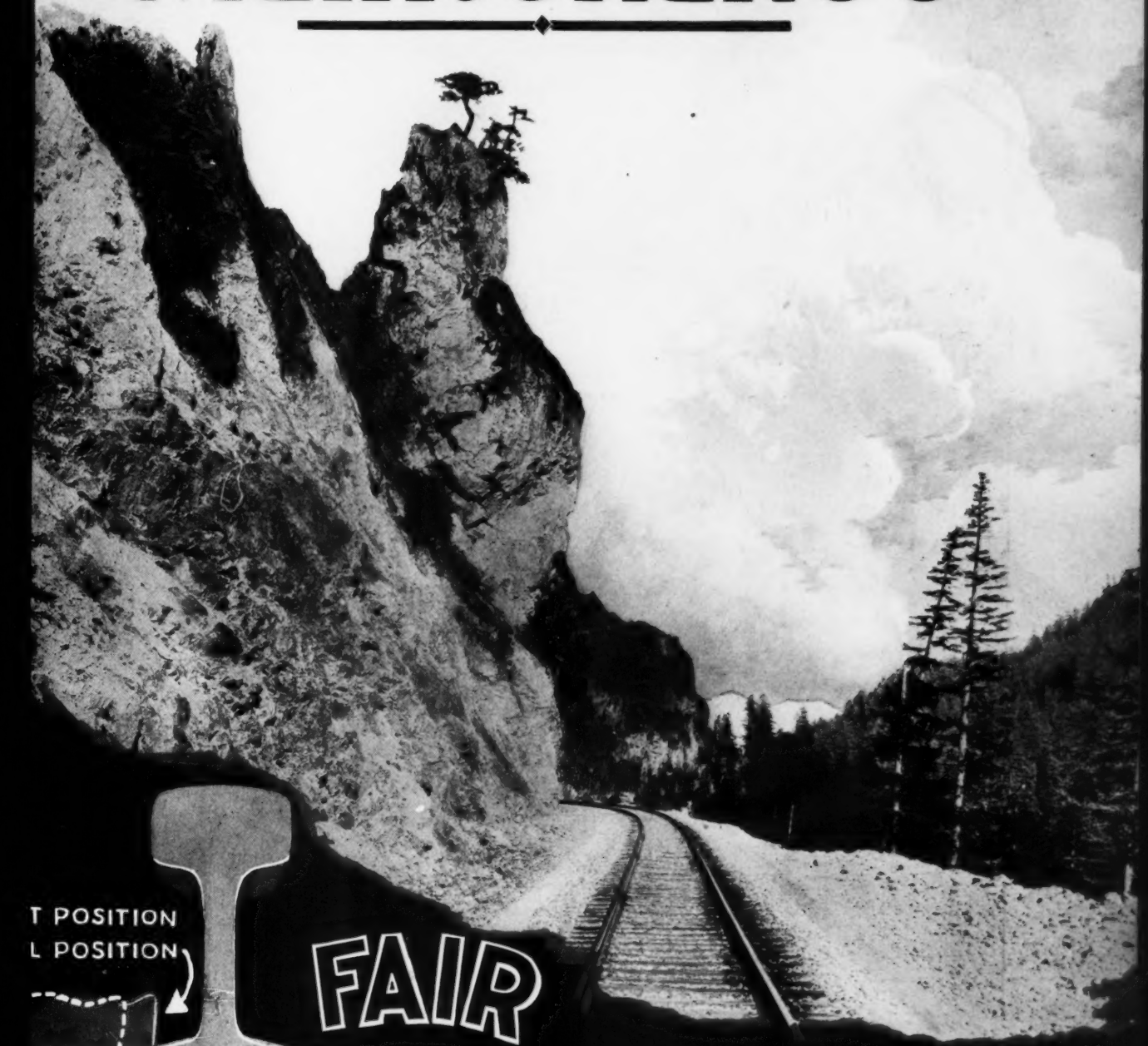
Sections
One

January, 1930

Railway Engineering and Maintenance



RAIL ANTI CREEPERS
for EASY, QUICK APPLICATION

CHICAGO MONTREAL THE P. & M. CO. NEW YORK LONDON PARIS

SIMPLICITY

Prolongs the service life — —

of rails, angle bars track bolts and ties

EVERY railroad executive responsible for maintenance costs who has applied HY-CROME knows that it is far cheaper insurance against rail replacement than frequent re-wrenching by track gangs. The trackman works in turns or part turns of a nut. The great reactive pressure and wide reactive range of HY-CROME is sensitive to the thousandth part of an inch.

On main lines where the heaviest trains on the fastest schedules are routine, HY-CROME non-fatiguing properties are unchanged by length of service.

HY-CROME is permanent compensation for wear on every track bolt where it is applied, and maintains permanent rail joint rigidity. And every executive knows that less wear on rail joint parts and less rail-end batter prolongs the service life of ties, rails, angle bars and track bolts. A HY-CROME TRACK TEST is convincing.

THE RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada

HY-CROME

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams Stt., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.
Alphabetical Index to Advertisers, Page 58 Classified Index to Advertisers, 54-56

THE LUNDIE TIE PLATE INSURES THE UTMOST IN CROSS TIE CONSERVATION

THE unique design of the bottom immediately lifts the Lundie Plate out of the ordinary class of tie plates to the plane of a truly economic device.

Long experience with millions of Lundie Plates in track, proves conclusively that this scientifically designed bottom while holding track to gauge does not cut a single fibre of the tie.

Lundie Plates, by the complete elimination of sharp tie destroying projections assures 100% service from treated ties.

THE LUNDIE ENGINEERING CORP.

285 Madison Ave., New York
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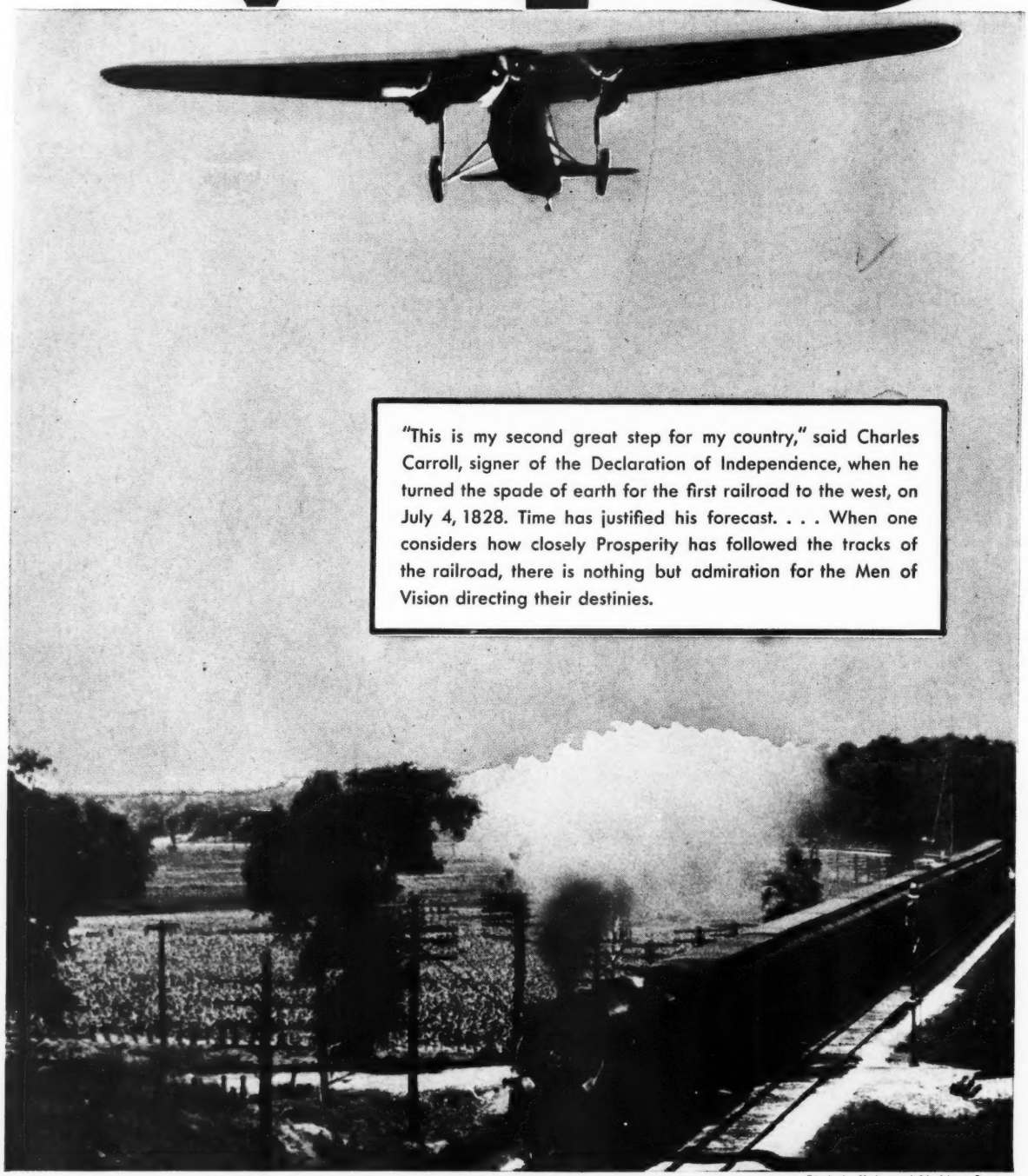
LUNDIE TIE PLATE

VTS

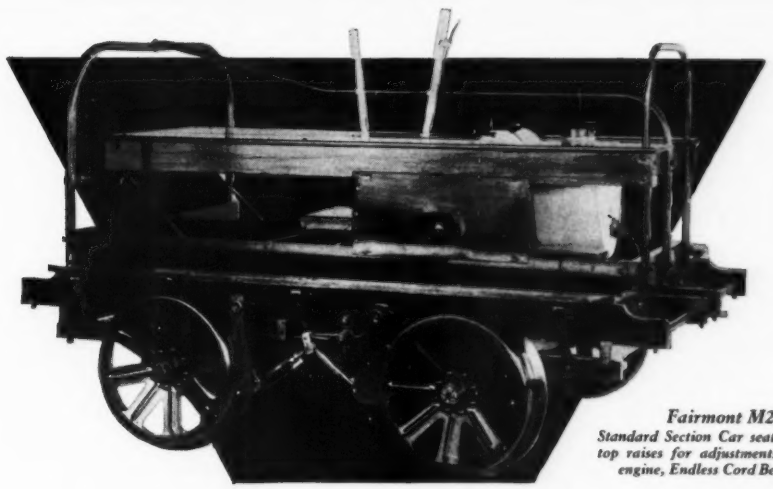


"This is my second great step for my country," said Charles Carroll, signer of the Declaration of Independence, when he turned the spade of earth for the first railroad to the west, on July 4, 1828. Time has justified his forecast. . . . When one considers how closely Prosperity has followed the tracks of the railroad, there is nothing but admiration for the Men of Vision directing their destinies.

Photo by Universal Air Lines System

THE RAILROAD WORLD

ION



Fairmont M2
Standard Section Car seats 10 men; top raises for adjustments; 6 H. P. engine, Endless Cord Belt Drive

Progress, whether measured in railroad systems or railway motor cars, depends upon foreseeing the needs of each dawning day. VISION made possible the brilliant expansion program of the railroads; and, in the sphere of motor cars, played the part that led to Fairmont supremacy.

Needs, as they developed, have always been anticipated by Fairmont. A survey of all worthy improvements, such as ball and roller bearing engines, show that the great majority were engineered and pioneered by Fairmont, in the striving toward ***"Lowest Over-All Cost Service."*** This goal has been attained —proved by the fact that ***over half the motor cars now in use are Fairmont products!***

FAIRMONT RAILWAY MOTORS, INC.
FAIRMONT, MINNESOTA, U. S. A.
General Sales Offices: 1356 Railway Exchange Bldg., CHICAGO
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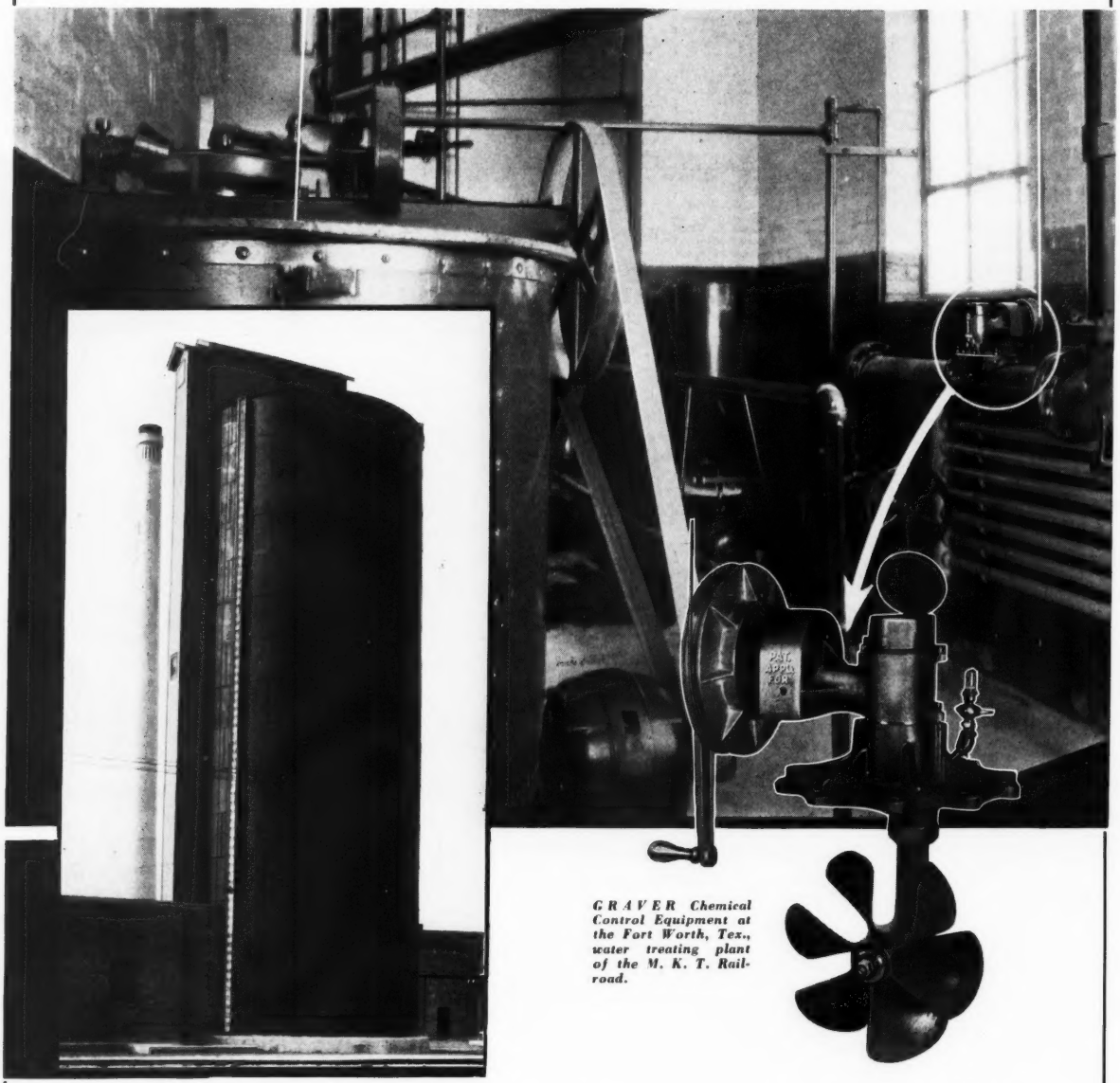
FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada *Foreign Representative:* BALDWIN LOCOMOTIVE WORKS
Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles, and safety appliances

Fairmont Mudge
Performance on the Job Counts

KNOWS FAIRMONT

GRAVER CHEMICAL CONTROL ACCURATE UNDER ADVERSE CONDITIONS



GRAVER Chemical Control Equipment at the Fort Worth, Tex., water treating plant of the M. K. T. Railroad.

The M.K.T. railroad recently installed Graver meter type chemical control equipment at two points, Smithville and Fort Worth, Texas. Both of these plants are operating at 25,000 gallons per hour.

The untreated water is unusual at Smithville, 7 to 17 grains hard with turbidity as high as 440 grains per gallon; at Fort Worth it is 6 to 10 grains hard with 30 grains per gallon turbidity. Clear, soft water has always been obtained at both points.

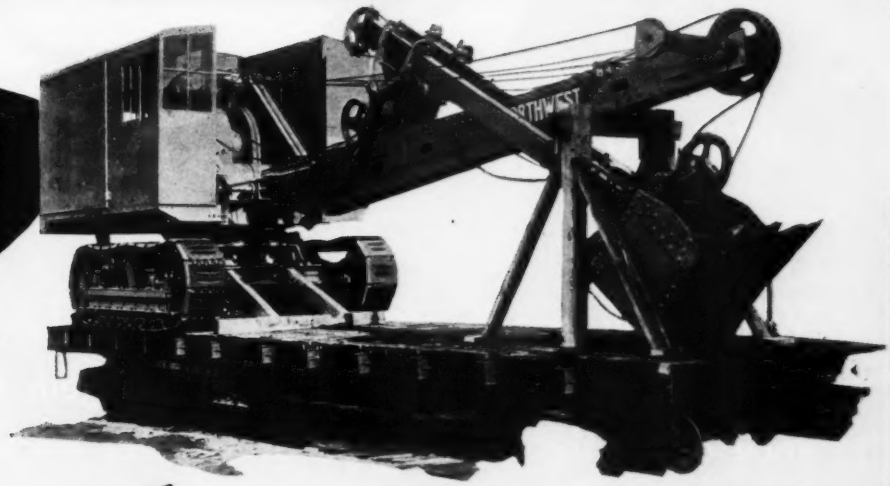
This meter control is used with all Graver softeners but will also function properly with any softening equipment. Write us for full particulars and quotations.

RAILROAD DIVISION

GRAVER *Founded 1857* *Corporation*

EAST CHICAGO, INDIANA

2 cubic yard capacity



-from your 1½ yd. NORTHWEST

YOUR Northwest Model 6 equipped with the Variable Speed Motor, Accelerator Controlled, means 2 Cu. Yds. capacity. This gives you a high capacity shovel, crane or dragline that can be loaded under its own power on one flat car without dismantling, and it comes within the railway weight specification and meets all standard tunnel and bridge clearances.

Write today for a catalog—let us show you motion pictures of Northwests on railway work.

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

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Chicago, Ill., U. S. A.

REM 1-Gray

NORTHWEST

Specify Casey

IN YOUR BUDGET

When you specify Casey-Jones, the STANDARD OF MOTOR CAR VALUE, you gain the assurance of the Right Type of Car for each Class of Service — Satisfactory Performance — Reasonable Cost of Replacement Parts — and the Best Investment at Any Price — Lowest Cost per Mile — for Years and Years.

SEND YOUR INQUIRIES ON ALL MOTOR CAR MATERIAL TO US and Create a Better Source of Supply as Well as More Favorable Prices. An Alert Organization of Experienced Men Will Help Solve Your Motor Car Problems.

SEND YOUR INQUIRIES TO OUR NEAREST OFFICE

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Koppel Industrial Car & Equipment Co.
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Jones

REG U.S. PAT. OFF.

AND YOUR INQUIRIES

THE RIGHT TYPE OF CAR FOR EVERY CLASS OF SERVICE

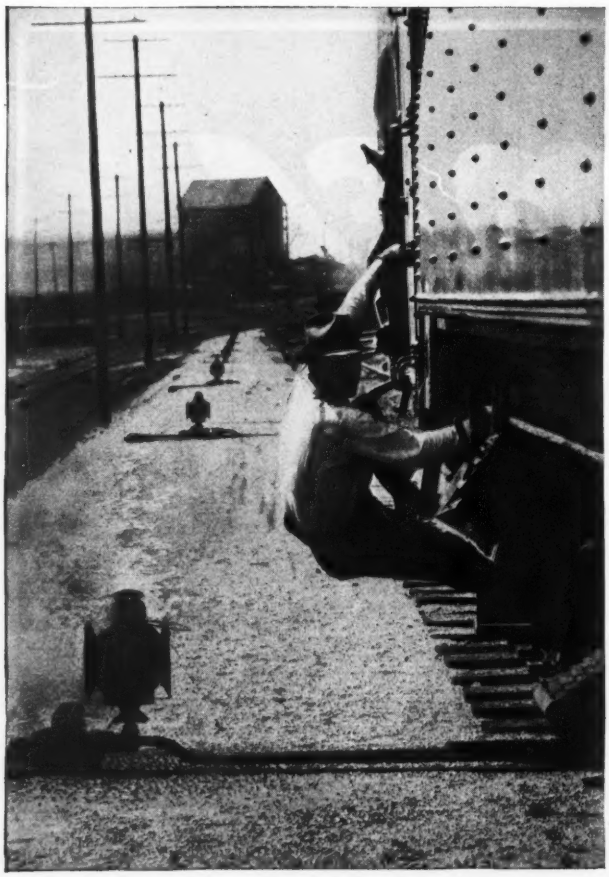
CLASS	TYPE		H. P.	CAPACITY	SERVICE
CLASS A	Casey Jones	561	40	4 TO 200 MEN -- TRAILERS	HEAVY DUTY
CLASS A	Casey Jones	561-H	40	24 MEN -- SEATED	HUMP SERVICE
CLASS A	Casey Jones	561-D	40	10 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A	Casey Jones	561-T	40	10 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A	Casey Jones	565	40	14 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A	Casey Jones	570	40	5 MEN -- ENCLOSED	INSPECTION SEDAN
All Types Above Equipped With New Model "A" Ford Motor 40 H.P. Self Starter					
CLASS A	Casey Jones	551	22	4 TO 150 MEN -- TRAILERS	HEAVY DUTY
CLASS A	Casey Jones	551-H	22	20 MEN -- SEATED	HUMP SERVICE
CLASS A	Casey Jones	551-T	22	8 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A	Casey Jones	551-D	22	6 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A	Casey Jones	555	22	12 MEN -- ENCLOSED	OFFICIAL INSPECTION
All Types in 551 Series Are Equipped With Model "T" Ford Motor 22 H. P.					
CLASS BB	Casey Jones	523	8	2 TO 60 MEN -- TRAILERS	EXTRA LARGE SECTION
CLASS BB	Casey Jones	523-CS	8-16	2 TO 120 MEN -- TRAILERS	WEED MOWING
CLASS B	Casey Jones	521	6	2 TO 30 MEN -- TRAILERS	STANDARD SECTION
CLASS B	Casey Jones	521-CS	6-12	2 TO 60 MEN -- TRAILERS	WEED MOWING
Types 523-CS and 521-CS Are Equipped With Speed Reduction Countershafts					
CLASS C	Casey Jones	531	4	1 TO 4 MEN	LIGHT INSPECTION

MODERN MOTOR CAR EQUIPMENT FOR EVERY PURPOSE

DISCER	Casey Jones	581	40	ALL DISCING WORK	BALLAST IMPROVEMENT
TRAILER	Casey Jones	562		24 MEN -- SEATED	MOVING LARGE GANGS
PUSH CAR	Casey Jones	500		6000 POUNDS	WORK CAR

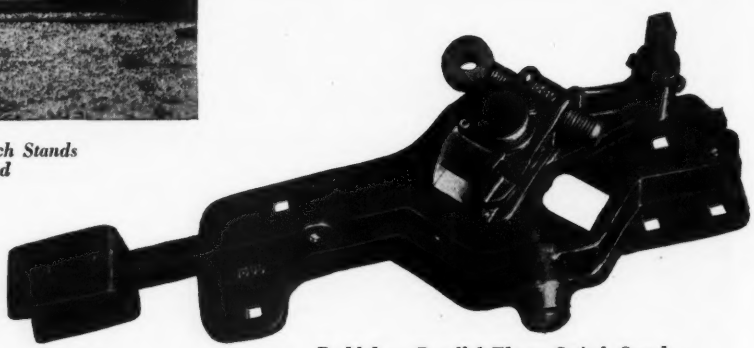
HYATT - TIMKEN - BOWER ROLLER BEARINGS FOR AXLES WITH DIAMETERS FROM 1" TO 3"
MOTOR CAR FRAMES AND CHASSIS OF ALL TYPES - SPECIAL MOTOR CARS - MOTOR CAR ENGINES 4-6-8 HORSEPOWER - REPLACEMENT AXLES AND BEARINGS - EQUIPMENT

FACTORY AND GENERAL OFFICES: EAU CLAIRE, WISCONSIN



Bethlehem Parallel Throw Switch Stands along ladder track in yard

Safe Extra Low Heavy-Duty



Bethlehem Parallel Throw Switch Stand Model 1222 with lamp tip

YARDS equipped with Bethlehem Parallel Throw Switch Stand, Model 1222, may be operated faster and with greater safety. This stand is heavily constructed and has a weighted throwing lever that makes throwing easier and insures closing of switch points. The height of the stand is only 4½ in. from the top of the tie to the base of the lamp.

There are only three moving parts in the Bethlehem Stand Model 1222. Adjustment of switch rod is quickly and easily made by screw-eye type crank. Locking ears are provided on the base of the stand so that the throwing lever can be locked. This stand may be used with a switch lamp and day target disc or, if desired, a target mast and lamp tip may be substituted for the plug lamp tip.

BETHLEHEM STEEL COMPANY
General Offices, BETHLEHEM, PA.

DISTRICT OFFICES
New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo Cleveland Detroit Cincinnati Chicago St. Louis San Francisco Los Angeles Seattle Portland Honolulu

Bethlehem Steel Export Corporation, 25 Broadway, New York City. Sole Exporters of Our Commercial Products

BETHLEHEM

Parallel Throw Switch Stand Model 1222

NATURE *has given the official OK"*

to ARMCO CULVERTS

THOUSANDS of "Veterans"—Armco Corrugated Iron Culverts in service under the railroads and highways of America for 24-years—are "proof-positive" of the superior durability of this *pure iron* product.

No other corrugated metal pipe has served so long. And no other product can approach Armco's recognition.

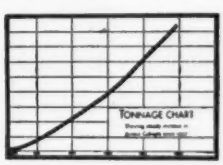
No other drainage product has undergone the thorough engineering research of Armco pure iron.

Under miles and miles of roadbed in the United States and Canada—in Nature's laboratory—it has been tested and now bears Nature's "OK" to a degree unequalled by any other corrugated metal culvert made today.

More than 50,000,000 feet of Armco Culverts are now used for drainage of all kinds.

Leading engineers and contractors—in all branches of drainage work—are regularly specifying Armco Culverts. The chart tells the story—note the steady increase in Armco Culvert sales since 1906.

Send the coupon for booklets giving the history of Armco Culverts in railroad drainage work.



ARMCO

ARMCO CULVERT MANUFACTURERS ASSN.
Middletown, Ohio

ARMCO
CULVERT
MFRS. ASSN.
Middletown, Ohio

Gentlemen:

Send me data on roadbed drainage with Armco Corrugated Iron Culverts.

Name.....

Address.....

Title.....

City.....*State*.....

R.E.M.1

"BIG LOUIE" RAISED 7012 FEET of TRACK IN ONE DAY

THIS was an exceptional record—but this Nordberg Power Jack consistently raised a mile of track or more a day last season when there were sufficient men behind to tamp that much track.

The picture shows what few men are required with a Nordberg Power Jack—1 Jack man, 4 tampers, 1 man ahead spotting ties—that's all. But to raise the same amount of track with hand jacks would require at least 12 jack men and 4 men digging jack holes.

The cost of aligning track is materially reduced because the 6½ x 50" shoe of the Power Jack doesn't slip or tip, and throw the track out of line as do hand jacks. Lifting action is supplied by two powerful screw jacks. The screw principle, together with the accurate controls, permits the correct amount of lift being secured at every raise.

Your 1930 track maintenance costs can be radically reduced by having one or more Nordberg Power Jacks on every ballasting gang.

NORDBERG MFG. CO.
Milwaukee, Wis.

G-E INSULATING VARNISH

Eliminates a Lot of Guesswork from Motor Repairs

INSULATING MATERIALS FOR EVERY PURPOSE

Varnishes, Oils, Shellacs, Paints

Filling and Sealing Compounds

Varnished Cloths and Tapes

Insulating Papers

Core Solder and Fluxes

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You can't tell, by a glance, whether insulating varnish will *lengthen* the life of your motor coils—as it should. But you *can* tell by its maker.

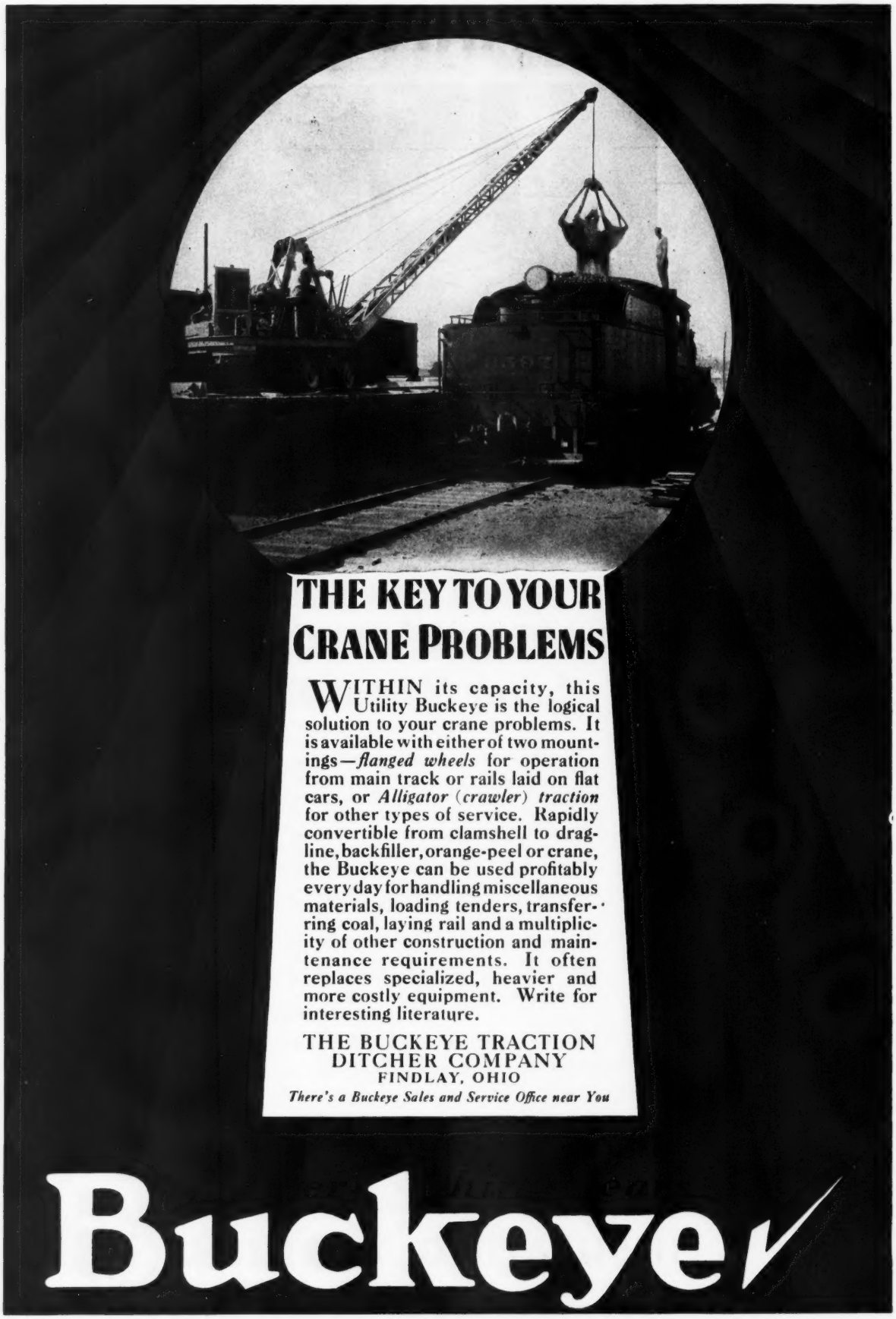
General Electric makes insulating varnishes . . . uses them exclusively in its own products . . . stakes its reputation on them. You can use them confidently . . . always. They cut maintenance costs.

Skilled varnish makers and highest grade ingredients *make them right* —a great research laboratory keeps them *right.*

You can get G-E Insulating Varnishes from General Electric Merchandise Distributors everywhere. For full information, write Section M-891, Merchandise Department, General Electric Co., Bridgeport, Conn.

MERCHANDISE DEPARTMENT · GENERAL ELECTRIC COMPANY · BRIDGEPORT, CONN.

GENERAL ELECTRIC
INSULATING VARNISH



THE KEY TO YOUR CRANE PROBLEMS

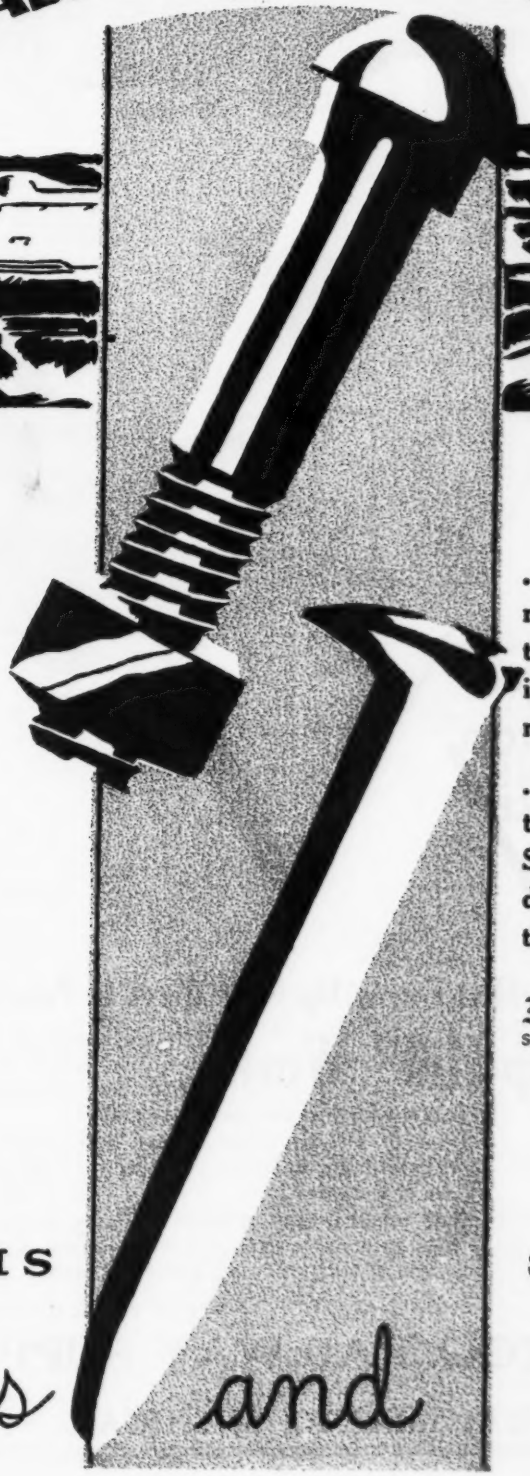
WITHIN its capacity, this Utility Buckeye is the logical solution to your crane problems. It is available with either of two mountings—*flanged wheels* for operation from main track or rails laid on flat cars, or *Alligator (crawler) traction* for other types of service. Rapidly convertible from clamshell to dragline, backfiller, orange-peel or crane, the Buckeye can be used profitably every day for handling miscellaneous materials, loading tenders, transferring coal, laying rail and a multiplicity of other construction and maintenance requirements. It often replaces specialized, heavier and more costly equipment. Write for interesting literature.

THE BUCKEYE TRACTION DITCHER COMPANY
FINDLAY, OHIO

There's a Buckeye Sales and Service Office near You

Buckeye

DEPENDABLE SPIKE & BOLT SERVICE



... Whether you want immediate or future shipment, the Illinois Steel Company is equipped to meet your requirements.

... Our plant, located in the Chicago Metropolitan Switching district, assures delivery to your railroad in the shortest possible time.

Illinois Steel Company
Subsidiary of United States Steel Corporation
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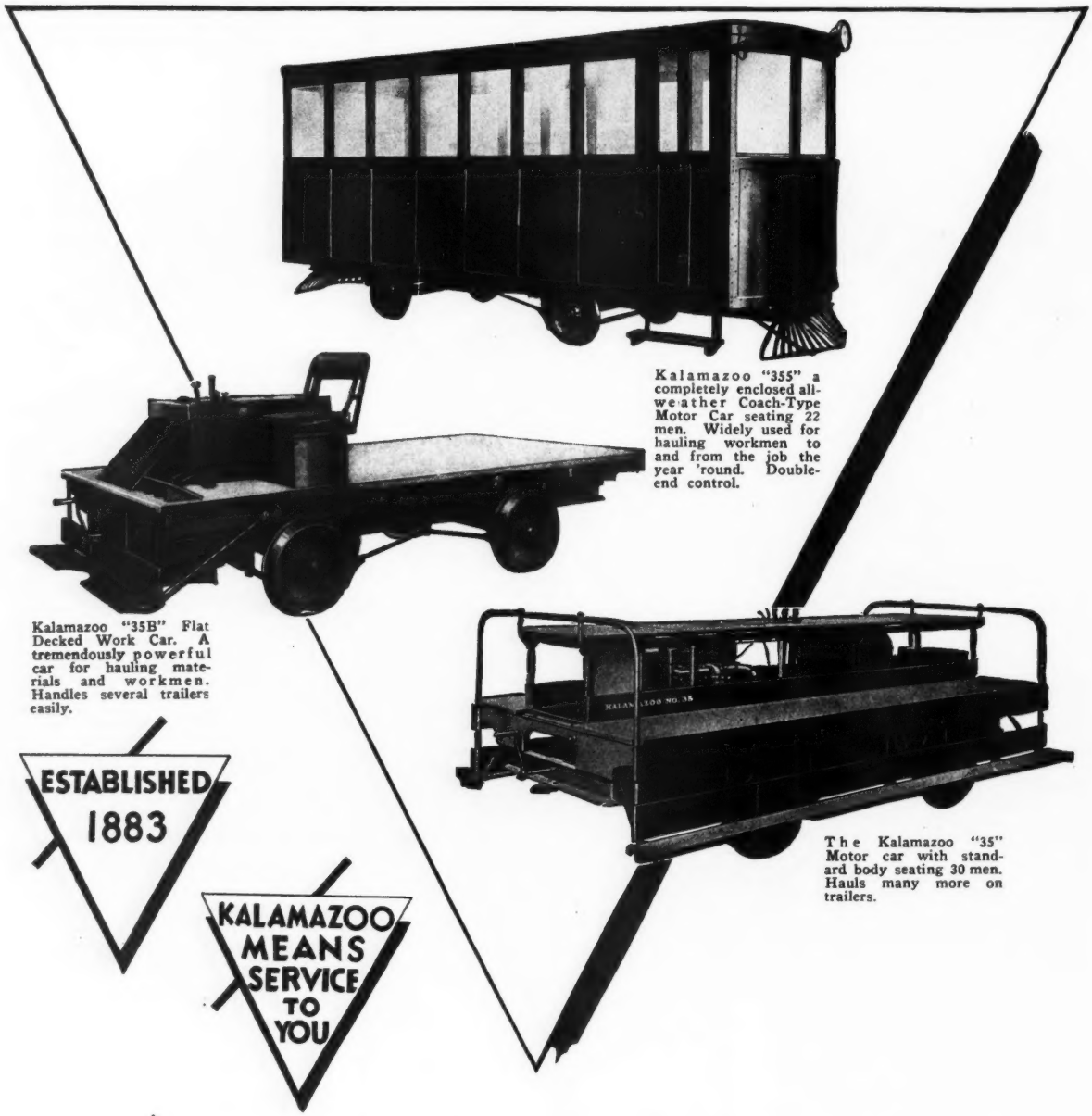
208 South La Salle Street, Chicago

ILLINOIS STEEL

Spikes and Bolts



Kalamazoo "355" a completely enclosed all-weather Coach-Type Motor Car seating 22 men. Widely used for hauling workmen to and from the job the year 'round. Double-end control.

Kalamazoo "35B" Flat Decked Work Car. A tremendously powerful car for hauling materials and workmen. Handles several trailers easily.

The Kalamazoo "35" Motor car with standard body seating 30 men. Hauls many more on trailers.

ESTABLISHED 1883

KALAMAZOO MEANS SERVICE TO YOU

Heavy Duty Service That Opens Up New Ways to Practical Economies

For "Up-Hill" Work

Kalamazoo 35 is as highly powered and as sturdily built as the heavy automobile truck and takes the place of a work train in transporting men and materials.

Hauling a large crew of men and several loaded trailers up the grades found on hump yards or on logging railroads is one of the jobs it is made for.

And you'll find it at work on many railroads taking men and supplies to construction and bridge jobs and distributing heavy materials to section crews along the line.

Write for catalog information.

KALAMAZOO RAILWAY SUPPLY CO.

Established 1883

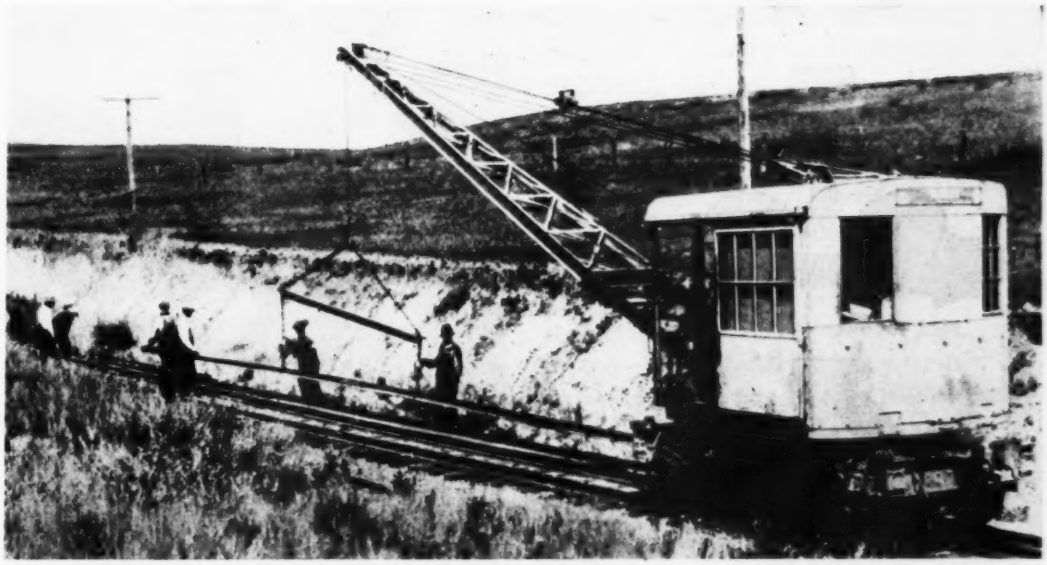
KALAMAZOO, MICHIGAN

Model 20

BURRO CRANE

Model 30

Travel Speeds



Model 20 Burro Crane relaying rail on single track line. Due to its fast travel speeds, the Burro quickly travels to a siding to clear the track for trains.

Burro Features

Utility
Long Reach
Low Overall Height
Travel Speeds
1½ to 20 miles per hour
Draw-Bar Pull
6000 to 7000 lbs.

Rated Capacities
Model 20 . . . . 11,000 lbs.
Model 30 . . . . 14,700 lbs.

Write for
Bulletin F-50

Cullen-Friestedt Co.
1300 S. Kilbourn Ave.
Chicago, Ill.

mean—

More Operating Hours

Burro travel speeds, ranging from 1½ to 20 miles per hour, make possible more hours of real crane operation by cutting to a minimum the amount of time lost in traveling from job to job.

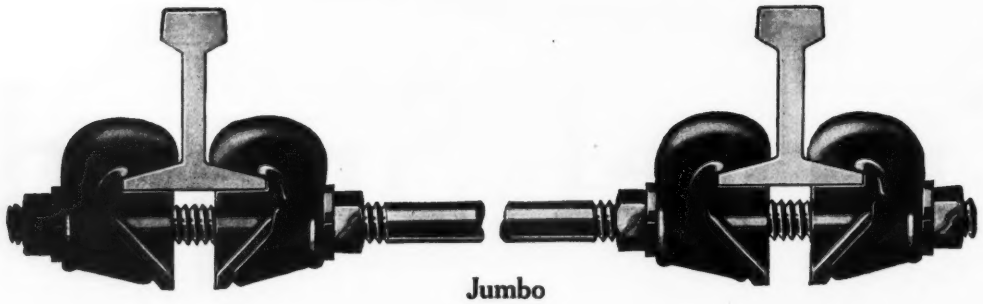
Increased Crane Uses

The Burro's uses are greatly increased because of its ability to quickly travel from one job to another under its own power.

Less Work Train Time

The Burro can very frequently be used for hauling men and material to and from work.

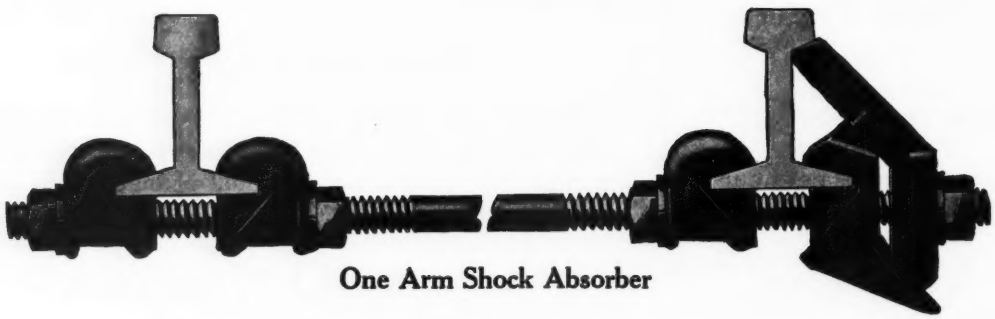
COOVER has a device for every purpose



Jumbo

Standard

Shock Absorber

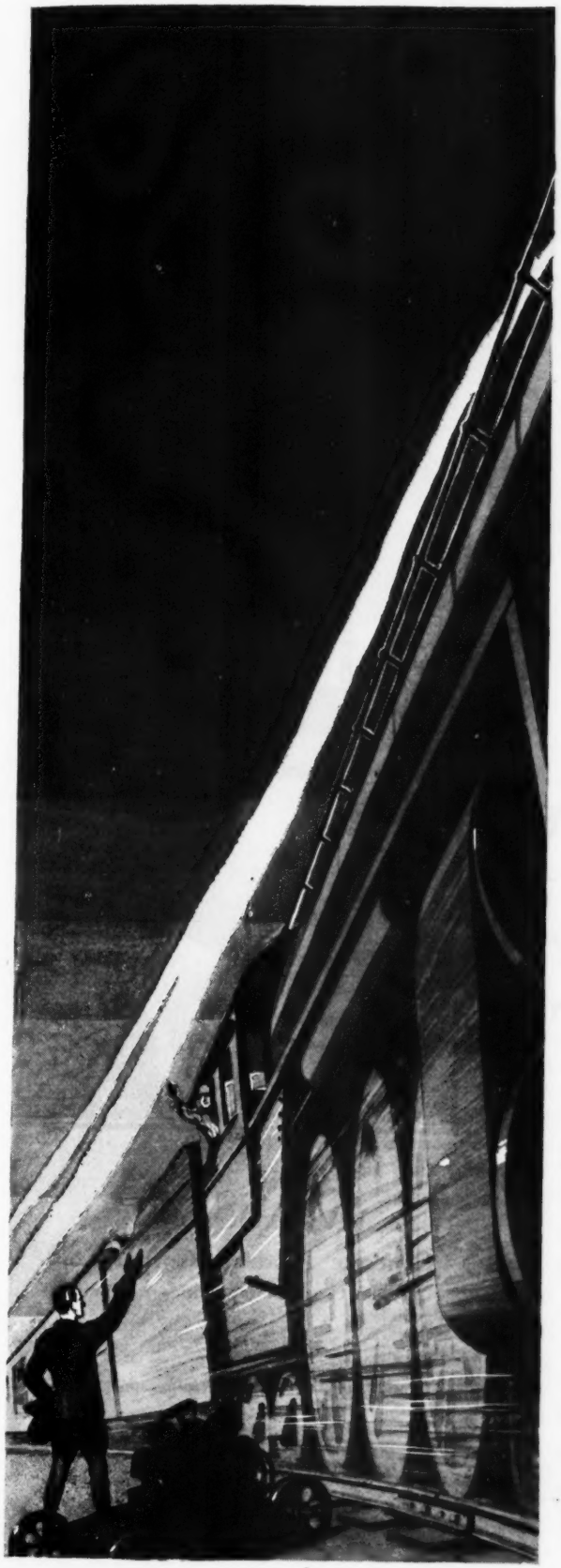


One Arm Shock Absorber

Write us
for complete Catalog

The Coover Railroad Track Brace Co.
DAYTON, OHIO

RAIL MAINTENANCE



without

Interruption

TWENTY-ONE CLASS A railroads, with a combined total of 83,495 miles of road, have renewed their rail ends electrically with "TELEWELD PROCESS," without once interrupting service. Twenty-one Class A railroads find "TELEWELD PROCESS" highly efficient and decidedly economical. TELEWELD should service your lines, too.

"TELEWELD PROCESS" welds electrically. It discards worn metal. The difficulties encountered from pre-heating are eliminated because TELEWELD takes the rail end cold and concentrates heat directly upon the point of work. This localization of heat prevents damage to rail, joint bars and signal bonds. It secures depth of penetration greater than any other method, insuring perfect fusion of new and old metal. It permits the use of harder, tougher metal with the result that the maximum service life is secured from every rail length. Accurate surface and cross-grinding machines insure perfect rail level and restoration of expansion. And TELEWELD does its work faster—a half mile of track per unit per day.

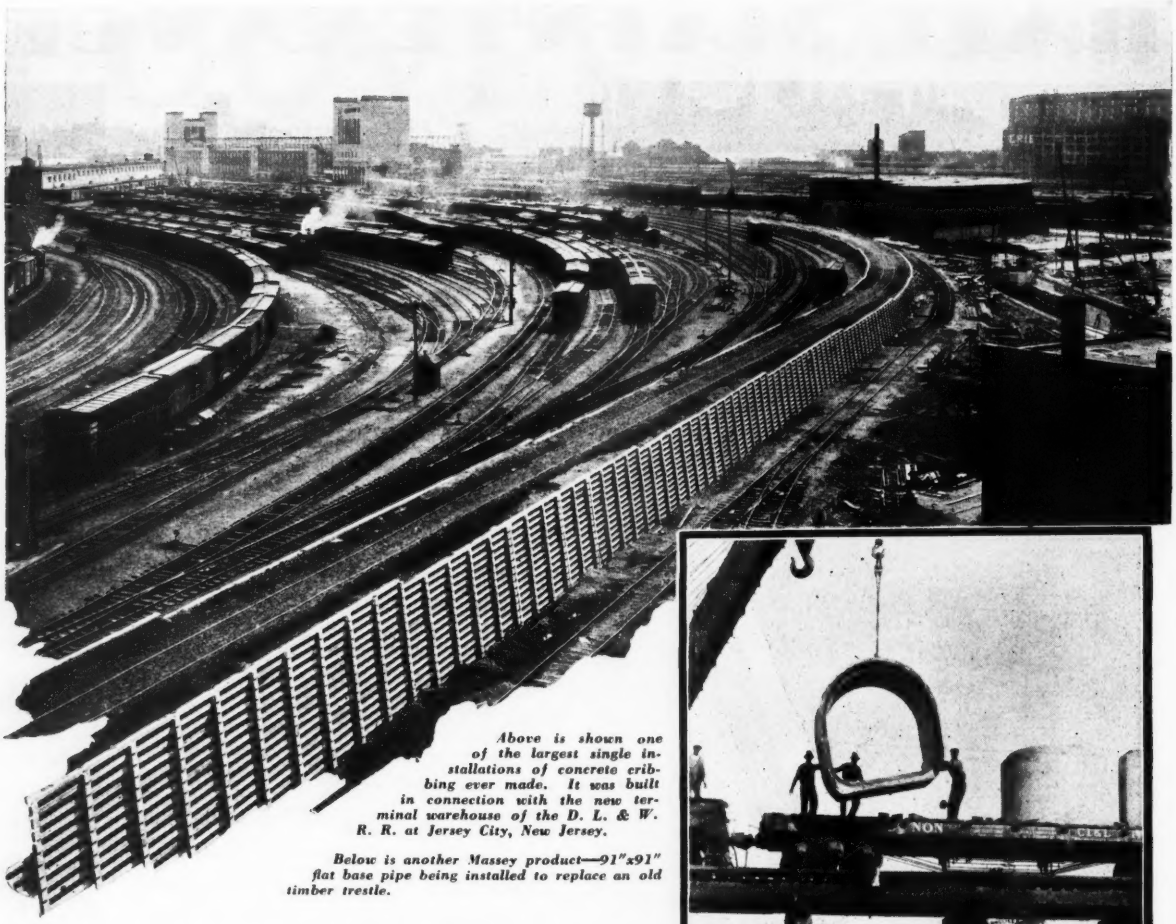
Part of TELEWELD service includes a complete survey of your steel. This is done, preliminary and without cost or obligation.

A TELEWELD engineer is waiting to serve you now. Send for him today.

ELECTRIC RAILWELD
SALES CORPORATION
RAILWAY EXCHANGE BLDG • CHICAGO

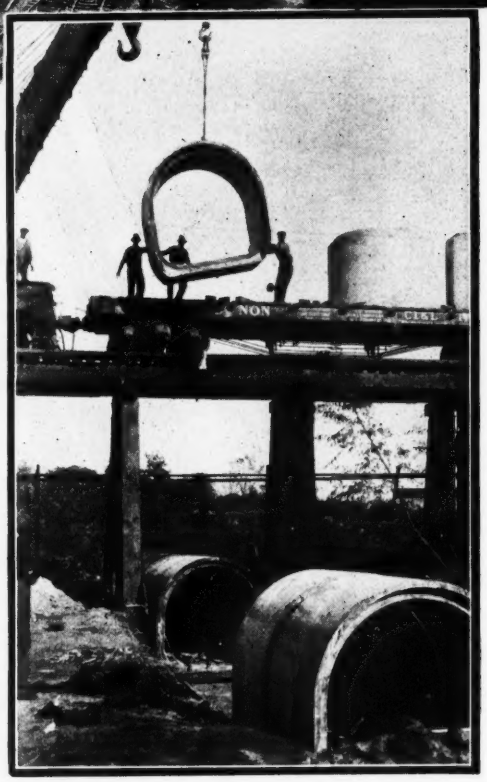
New York • Cleveland • Salt Lake City • Boise • Spokane • San Francisco

TELEWELD
A MILE AT A TIME



Above is shown one of the largest single installations of concrete cribbing ever made. It was built in connection with the new terminal warehouse of the D. L. & W. R. R. at Jersey City, New Jersey.

Below is another Massey product—91"x91" flat base pipe being installed to replace an old timber trestle.



MASSEY
Reinforced Concrete
PRODUCTS

Massey culvert pipe, under-passes, houses, cribbing and other standard units go into many railway budgets every year. Such continued and growing reliance on Massey products can only be accounted for by satisfactory service, long life and ultimate economy. Massey designs and construction standards have successfully stood the test of time. Massey engineers will gladly work with you to meet any special condition for which these products may be applied.

MASSEY

Concrete Products Corporation

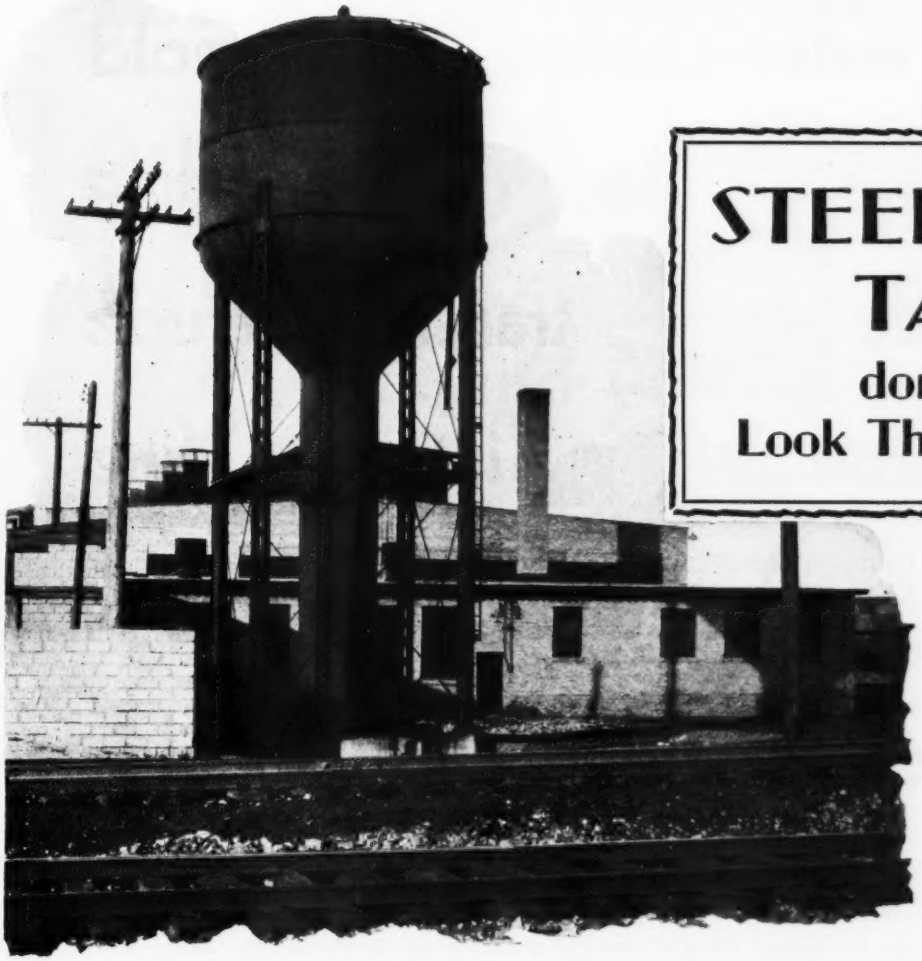
Peoples Gas Building, Chicago, Illinois

Sales Offices:

New York, Atlanta, Cincinnati, Minneapolis, St. Louis Los Angeles

Canadian Concrete Products Co., Limited Transportation Building, Montreal, Que.

REM 1-Gray



STEEL TANKS don't Look Their Age

From all appearances, this Horton roadside delivery tank on the Illinois Central railroad looks like a new structure.

YOU can't tell the age of a steel tank by looking at it. It may have a number of years to its credit and still look new, particularly if painted regularly.

Steel tanks are designed so that they retain their original condition. Accessories or portions of the tank such as the roof, tower rods, etc., are all made of steel. They are well constructed so as not to sag or come loose and give the tank a dilapidated appearance.

When re-painted, steel tanks not only look but are like new structures. The properties of the steel remain the same. It is just as strong as when new, just as impervious to water and uniform throughout.

If you will write our nearest office, we will be pleased to send you, without obligation, a copy of the booklet illustrated at the left or quotations on any steel tanks you contemplate installing.

Ask for a Copy of this Booklet

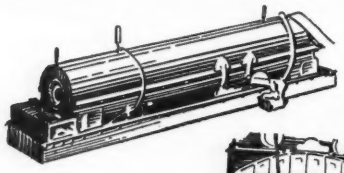
CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Term. Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	1036 Healey Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.
Boston	1522 Consolidated Gas Bldg.	Havana	Apartado 2507

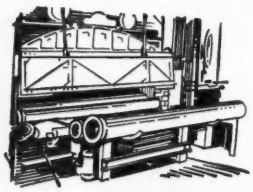
119

HORTON TANKS

This water-cooled metal mold



and this annealing furnace



transform crude cast iron

into the fine grained

metal of deLavaud pipe which is strong and flexible

Examine a section of deLavaud cast iron pipe and note the fine and even grain of the metal. Laboratory tests have shown that deLavaud pipe combines flexibility with at least 25% greater strength.

The reason for the fine granular structure of deLavaud pipe metal is due to its unique process of manufacture. deLavaud pipe is cast in a rapidly revolving cylindrical mold. This mold is cooled by a specially constructed water jacket. When the molten iron comes in contact with the chilled surface of the mold, the abrupt change of temperature brings about the uniformly fine division of the iron particles.

Immediately upon leaving the machines, every length of deLavaud pipe is placed in a large annealing oven. Here *accurately controlled* heat further improves the metal, eliminating all possibility of casting strains, and bringing about the flexibility and strength that only deLavaud pipe can offer.

Let us send you the deLavaud handbook which contains complete information about deLavaud pipe and fittings.

United States Pipe and Foundry Co., Burlington, N.J.

Our pipe bears the "Q-check" trademark of The Cast Iron Pipe Research Association.

Branch Offices: New York, Philadelphia, Pittsburgh, Cleveland, Buffalo, Chicago, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, San Francisco, Los Angeles

You *expect* more from a "Sheffield" . . . and you *get* more

There is a record of service back of the "Sheffield" name that makes purchasers of these motor cars expect greater dependability, longer life and lower maintenance than they expect of any other cars.

And "Sheffield" users *get* greater service because these cars are the product of 34 years' experience in motor car building—with the added advantage of unequaled research and manufacturing facilities. "Sheffield" was first on the rails. It is still first.

"Sheffield" motor cars are not the lowest *priced* cars on the market. They are built with every economy known to modern production methods. But these economies include none which impairs efficiency and dependability. If a car the equal of "Sheffield" is ever produced—the "Sheffield" will be lower priced.

"Sheffield" is the *lowest over-all cost* car on the market—the greatest dollar-for-dollar value in railway motor cars.

1930
begins the
SECOND CENTURY
of building
FAIRBANKS SCALES

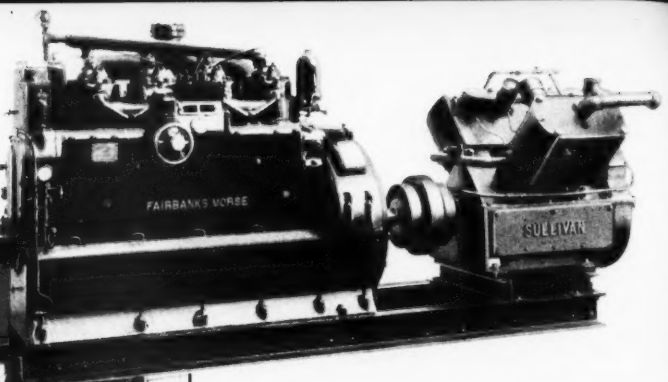
FIRST
on the rails
and *still* first

TIMKEN BEARING
EQUIPPED

FAIRBANKS-MORSE

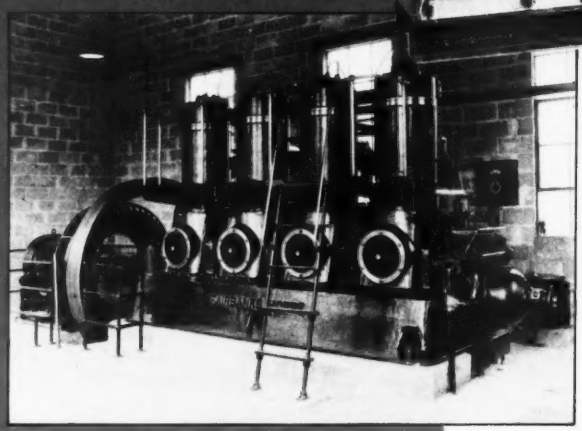
MOTOR CARS

POWER · BUILDING · AND · WELDING · EQUIPMENT



F-M Diesel direct-connected to Sullivan V Type compressor

240 hp. F-M Diesel engine with direct-connected generator and exciter



Cut power costs with F-M Diesels

Driving machinery direct from the crank shaft or turning electric generators, more than 1,750,000 Fairbanks-Morse Diesel horsepower are cutting power costs in industry—often as much as 50 per cent. F-M Diesel economy and dependability are not new to railroads. These engines have been used for years in railroad power plants and to operate coaling stations, pumping equipment, machine shops, air compressors, etc. The more recent development of higher speed and more compact units has resulted in cranes, shovels and portable power plants showing new economy and efficiency under F-M Diesel power. Diesel driven locomotives are also being used.

The reason for F-M Diesel economies is basic. The Diesel engine converts into actual energy a much larger percentage of fuel burned than does any other form of power. The Diesel burns low grade, cheap fuel oil.

As the largest manufacturers of Diesels in the United States, Fairbanks, Morse & Co. has developed a standardized line of engines of extreme simplicity and lowest over-all operating costs. Recommendation as to the type of engine best suited to your requirements and data as to the actual savings to be secured through the use of F-M Diesel power will be supplied by Fairbanks-Morse engineers.

FAIRBANKS, MORSE & CO., Chicago
32 branches at your service throughout the United States

1930 begins the **SECOND CENTURY** of building **FAIRBANKS SCALES**

ORA21.2

FAIRBANKS-MORSE
DIESEL ENGINES
POWER · PUMPING · AND · WEIGHING · EQUIPMENT

What a Whale of a Difference a full Dipper Makes -

It's the load which the dipper digs that really counts in a shovel, rather than mere size or rated capacity. A full dipper at each bite does make a whale of a difference in your daily output and particularly so when your shovel is built to stand up under such service.

One of the many satisfied users of Industrial Brownhoist Shovels writes, "Our yard and one-eighth shovel is mining more than twelve hundred square yards of lime rock daily. We can recommend these shovels to anyone whose work calls for high class, efficient and substantial equipment and we consider them the best we have seen in our many years of experience."

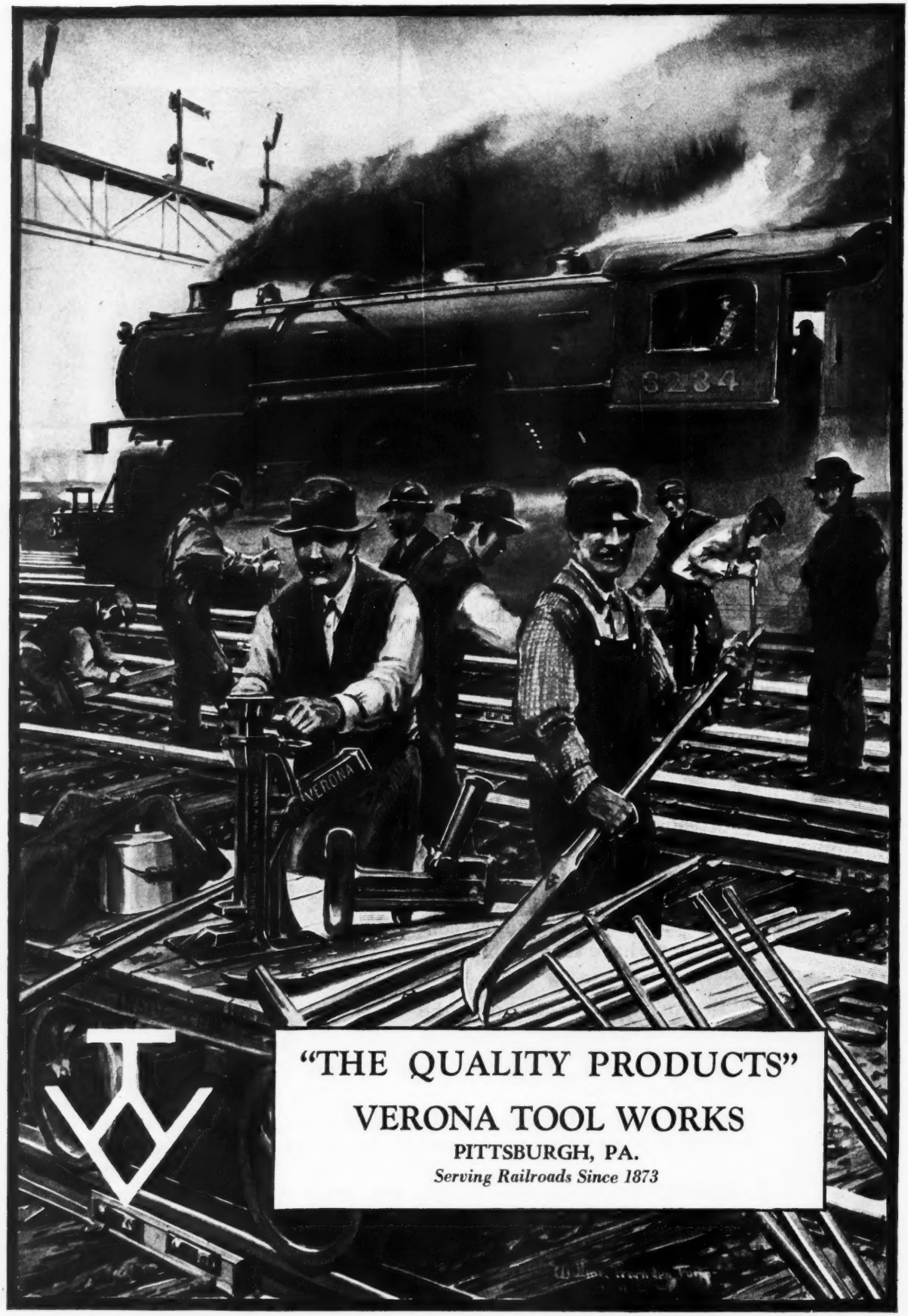
Industrial Brownhoist manufactures the type of shovel best suited to your needs—capacities range from ½ to 1¼-yard dippers.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST



"THE QUALITY PRODUCTS"

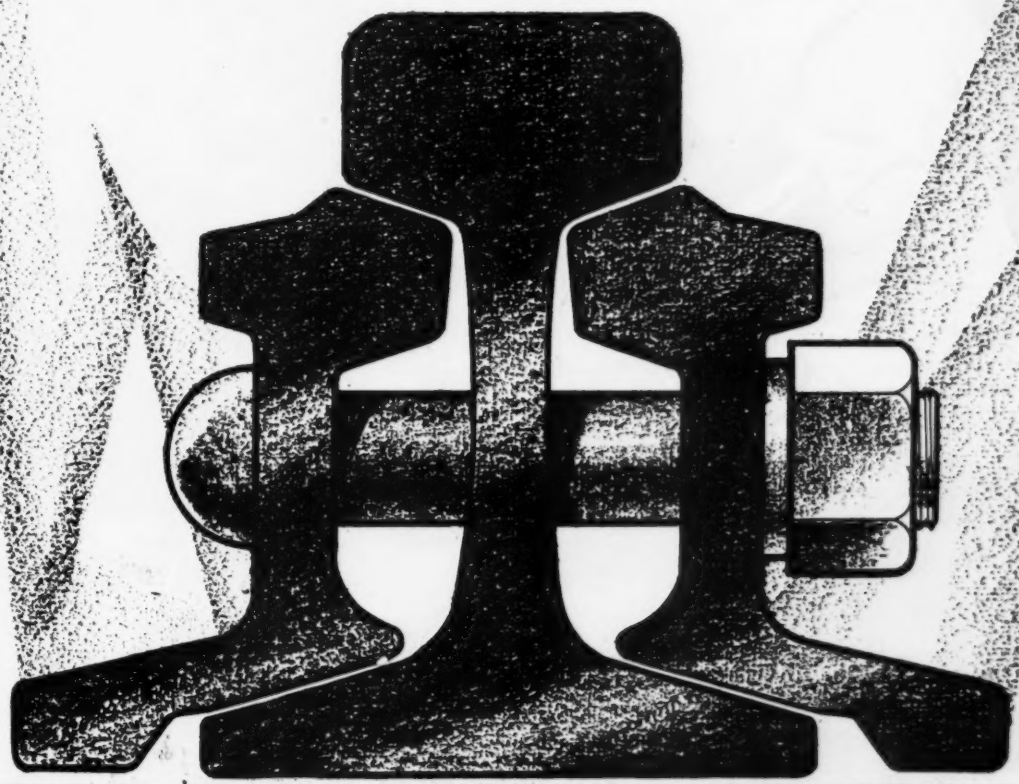
VERONA TOOL WORKS

PITTSBURGH, PA.

Serving Railroads Since 1873

STEEL SERVICE

CONTROL of manufacture from the mining of the ore until the finished product is ready for shipment, combined with extensive and modern manufacturing facilities, enable us to promptly and efficiently supply your steel requirements. Carnegie products of special interest to railroads include Standard Rails and Heat Treated Splice Bars, Structural Shapes, Bar Mill Products, Wrought Steel Wheels, Forged Steel Axles and Steel Sheet Piling. Let us quote on your next requirements.



CARNEGIE
RAILS *and* SPLICES

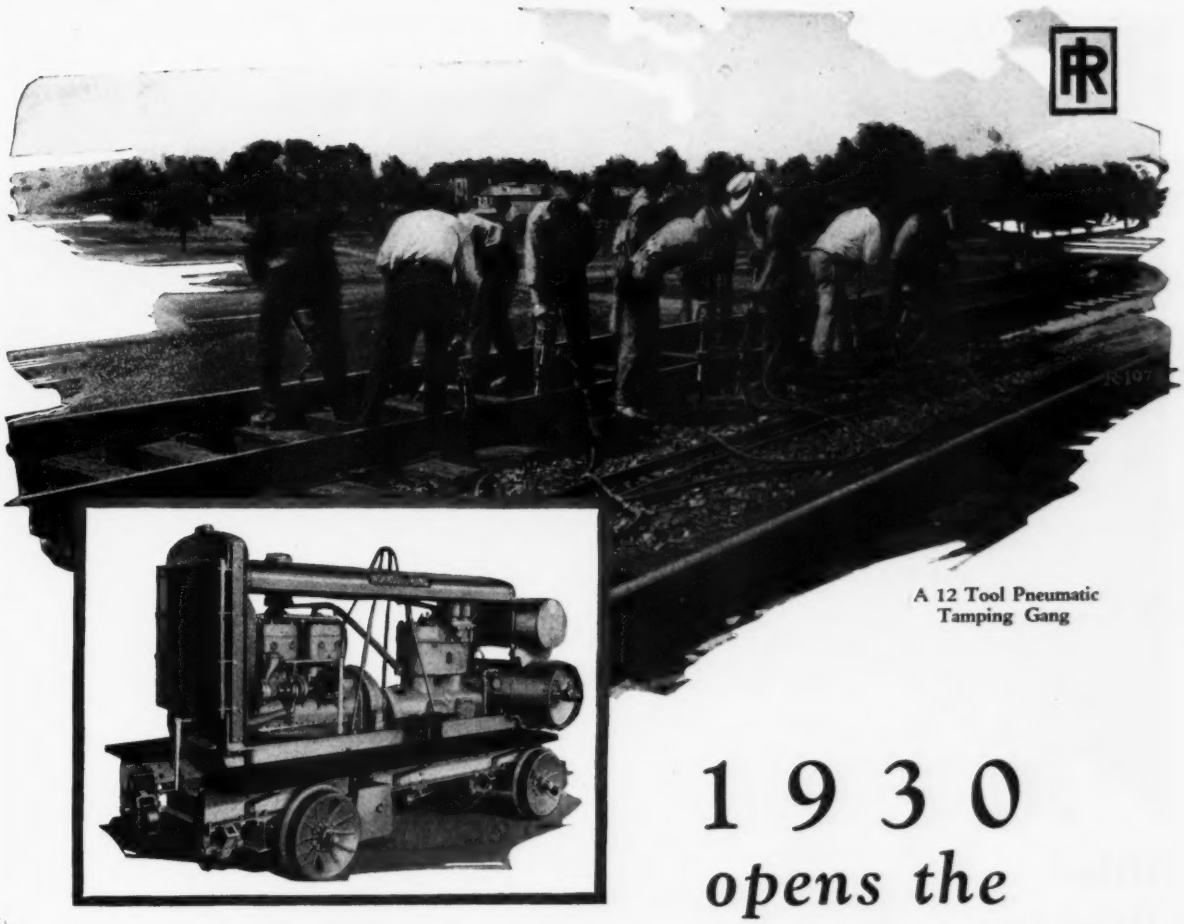
Products of CARNEGIE STEEL COMPANY, Pittsburgh, Pa.—*Subsidiary of United States Steel Corporation* 37

The DIESEL GIANT WORKS *for* LOW WAGES

DIESEL POWER is a giant. No other internal combustion power is so mighty. No other internal combustion power can give you such huge shovel output. Yet this giant works for low wages . . . costs 75 to 85% less than gasoline power. For P & H Diesel engines require but half as many gallons of fuel as gasoline engines—fuel costing only one-third to one-half as much per gallon.

And Diesel Power, this giant that works for low wages, has a feature not possessed by other types of internal combustion power. Its torque increases when slowed down below 50% of normal speed in heavy digging. It gives you most when you need most. That means increased yardage . . . 10 to 15% more in heavy service. These machines are built in sizes from 1 to $3\frac{1}{2}$ cubic yards capacity. Send for special Diesel folder. HARNISCHFEGER CORPORATION, 3834 National Avenue, Milwaukee, Wisconsin.

P & H *Diesel* EXCAVATORS



A 12 Tool Pneumatic Tamping Gang

1930 *opens the*

18th year of I-R tamping service

Since the introduction in 1913 of Ingersoll-Rand pneumatic tamping outfits, thousands of miles of the finest track in the world have been tamped with these units. They have had an important part in the development of modern standards of track maintenance.

Smoother, safer, and longer lasting track are among the improvements obtained. In addition, the labor item for maintenance has been materially reduced and the laborer relieved of much arduous work.

Many of the original Ingersoll-Rand compressor units have been in service as long as fifteen years before being retired for more modern I-R machines. Starting with the first machines in 1913, I-R tamping units have been constantly improved until today they are outstanding in efficiency and reliability. Only many years of experience could have made possible the refinements in design incorporated in the present Ingersoll-Rand units.

INGERSOLL-RAND COMPANY - 11 Broadway - New York City

Branches or distributors in principal cities the world over

For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec

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Ingersoll-Rand

Other Reading Specialties:

"Resco" Cast Steel Guard Rail Clamps; Acco Drop-Forged Guard Rail Clamps; Samson Rail Benders; Reversible Rail Benders; Acco "Triple A" Rail Benders; Compromise Joints

ACCO ONE-PIECE GUARD RAILS

Lugs are an integral part of the casting which assures accurate and fixed alignment of flangeway and elimination of any possibility of tipping over. One steel casting takes the place of multitudinous parts.

Write or wire for complete information. Mention, in your inquiry, rail section and tie spacing.

READING SPECIALTIES

AMERICAN CHAIN COMPANY, *Inc.*, BRIDGEPORT, CONN.

World's Largest Manufacturers of Welded and Weldless Chains for All Purposes

In Canada: Dominion Chain Company, *Limited*, Niagara Falls, Ontario

Brake chains; Train chains; Sling chains; Switch chains; Gate chains; Wrecking chains; Crane chains; End Door chains; Door Operating chains; Brake Beam chains; Brake Beam Safety chains; etc.

KREOLITE

LIFE OF TREATED TIMBER DEPENDS UPON CHARACTER OF PRESERVATIVE USED

In order to insure the purchaser of a pure and uniform product, *we distill all of our own creosote oil.*

By our own method of distillation, it is possible to insure to the purchaser a uniform, pure Creosote Oil of any grade desired.

We have treated hundreds of millions of feet of timber in the past seventeen years without a single instance of decay.

Enormous stocks of Railroad Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked, stacked, and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill. (East St. Louis).

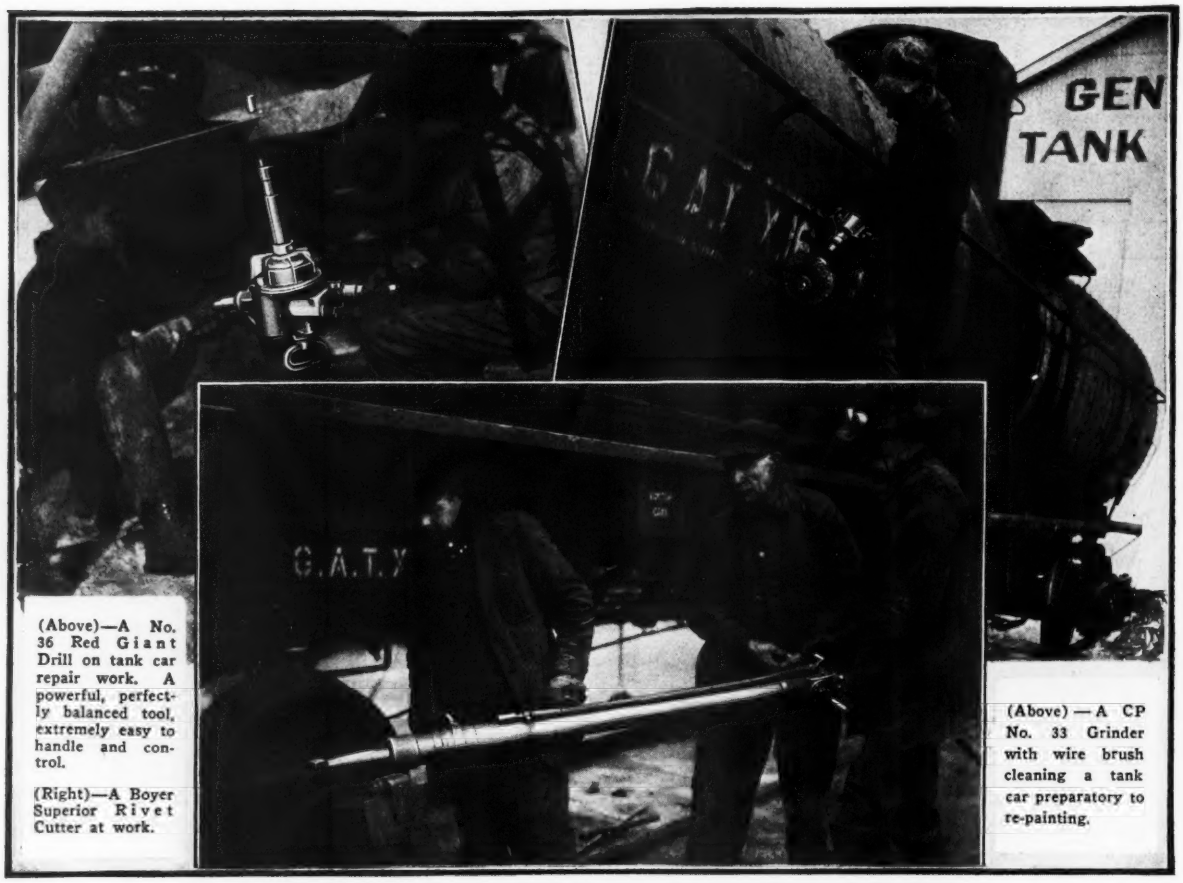
We specialize in framing timbers to your plan before treatment.

Quick shipment on short notice.

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES



(Above)—A No. 36 Red Giant Drill on tank car repair work. A powerful, perfectly balanced tool, extremely easy to handle and control.

(Right)—A Boyer Superior Rivet Cutter at work.

(Above)—A CP No. 33 Grinder with wire brush cleaning a tank car preparatory to re-painting.

CP Pneumatic Tools Speed Up Repair Work

A CAR can't earn a profit while it is in the repair shop. The quicker it is put in good order, the quicker it becomes a profit earner. Such jobs as riveting, rivet busting, drilling, reaming, buffing, cleaning and wood boring—can be done QUICKLY, ACCURATELY and ECONOMICALLY with CP tools.

If you haven't a copy of our latest 84-page catalog of pneumatic tools (No. 562) we'll gladly send you one on request.

CHICAGO PNEUMATIC TOOL CO.

RAILROAD DEPARTMENT

6 East 44th St., New York
175 First St., San Francisco
310 So. Michigan Ave., Chicago
1004 Mutual Bldg., Richmond, Va.
Terminal Tower, Cleveland

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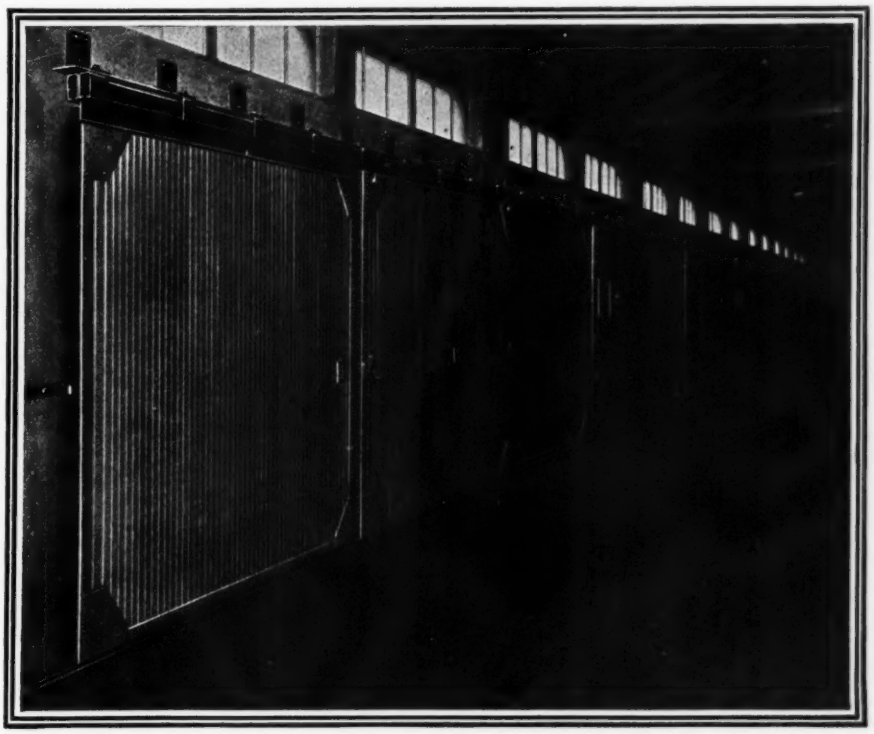
Sales and Service Branches all over the World



SupeR-Way doors and hardware as installed in Illinois Central Freight House at Indianapolis, Ind.

SupeR-Way

Doors and Hardware

Here is doorway equipment that is meeting the most exacting standards of many of the largest railroads and industries.

The construction of SupeR-Way doors is exactly suited to the strenuous abuse which most doors in roundhouses, freight houses and warehouses must withstand.

SupeR-Way doors are built with a heavy steel frame securely welded. Solid wood members are tongued and grooved and securely spiked together inside the steel T. frame without a spike exposed.

SupeR-Way Hardware, either hangers or hinges, is fitted directly to the steel members—"steel to steel" contact. All weight is carried by the steel frame and corner-bracing so there is no possibility of sagging, warping or pulling apart.

Both doors and hardware are made to take care of any size opening.

Construction details and catalog of designs will be mailed on request.

Richards-Wilcox Mfg. Co.

"A Hanger for any Door that Slides"

New York · · · AURORA, ILLINOIS, U.S.A. · · · Chicago

Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines
Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit

Montreal · RICHARDS-WILCOX CANADIAN CO., LTD., LONDON, ONT. · Winnipeg

RUST-PROOFED!

when the paint is pure Red-Lead

TRADEMARKED LEAD PIPE

Lead pipe of our manufacture now carries the Dutch Boy trademark and also National Lead Company's name. This marking, stamped into the pipe every few inches, is your assurance of quality, proper wall thickness and correct weight per foot.

WHERE steel-work must serve unweakened for many years . . . on bridges, ships, tanks, steel structures of every type . . . there you find paint made of pure red-lead used.

Tested by more than a century of universal use, pure red-lead paint has proved its high protective value . . . its remarkable ability to prevent rust . . . its extreme durability even under severe conditions. It is recognized by paint authorities everywhere as the standard protective paint for metal.

Fine, uniform, highly oxidized . . . there is no better red-lead obtainable than Dutch Boy red-lead. It comes in two forms . . . paste and liquid. The liquid (ready for the brush) is supplied in six colors—natural orange-red, light and dark brown, light and dark green, and black. The paste comes in natural orange-red and can be shaded to dark colors.

NATIONAL LEAD COMPANY

New York, 111 Broadway ✓ Buffalo, 116 Oak Street Chicago, 900 West 18th Street ✓ Cincinnati, 659 Freeman Avenue ✓ Cleveland, 820 West Superior Avenue ✓ St. Louis, 722 Chestnut Street ✓ San Francisco, 235 Montgomery Street ✓ Boston, National-Boston Lead Co., 800 Albany Street ✓ Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Avenue ✓ Philadelphia, John T. Lewis & Bros. Co., Widener Bldg.

DUTCH BOY RED-LEAD

PROOF of ECONOMY in TRACK MAINTENANCE!

"Report good service from all points rebuilt by this process. All points standing up well."

- First Division.

"Test shows considerable saving in use of these points, providing they are kept to conform with our standard points where they fit against stock and running rails."

- Fourth Division.

"All those installed still in use and giving satisfactory results."

- Third Division.

"Getting good results. Had one with a defect back of where it had been rebuilt. Points to be rebuilt should be carefully selected."

- Second Division.

One Great Railroad Now Reports Its Results

The facts are here for everyone to read! Four divisions of a prominent trunk line have together reported favorably on the service of the Morrison Railway Supply Corporation.

Actual tests prove the economy and durability of Switch Points, Frogs, Crossings and Rails reconditioned by the special and patented processes of this company.

Economy! But always SAFE economy, without unnecessary interruption of service or the gamble of defective trackage.

SALES OFFICES

41 Morrison Building BUFFALO, N. Y.

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MORRISON RAILWAY SUPPLY CORP.

DEVOTED TO ECONOMIES IN TRACK MAINTENANCE

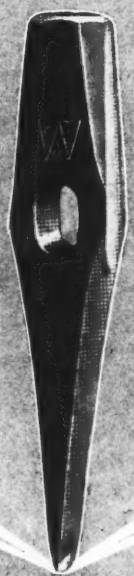
PLANTS: BUFFALO—CHICAGO—INDIANAPOLIS—VERONA, PA.—MARYSVILLE, PA.

WOODINGS TRACK CHISELS

THREE DESIGNS
THREE GRADES OF STEEL
HIGH CARBON, ELECTRIC FURNACE
ALLOY STEEL

No. 2-AA

No. 2

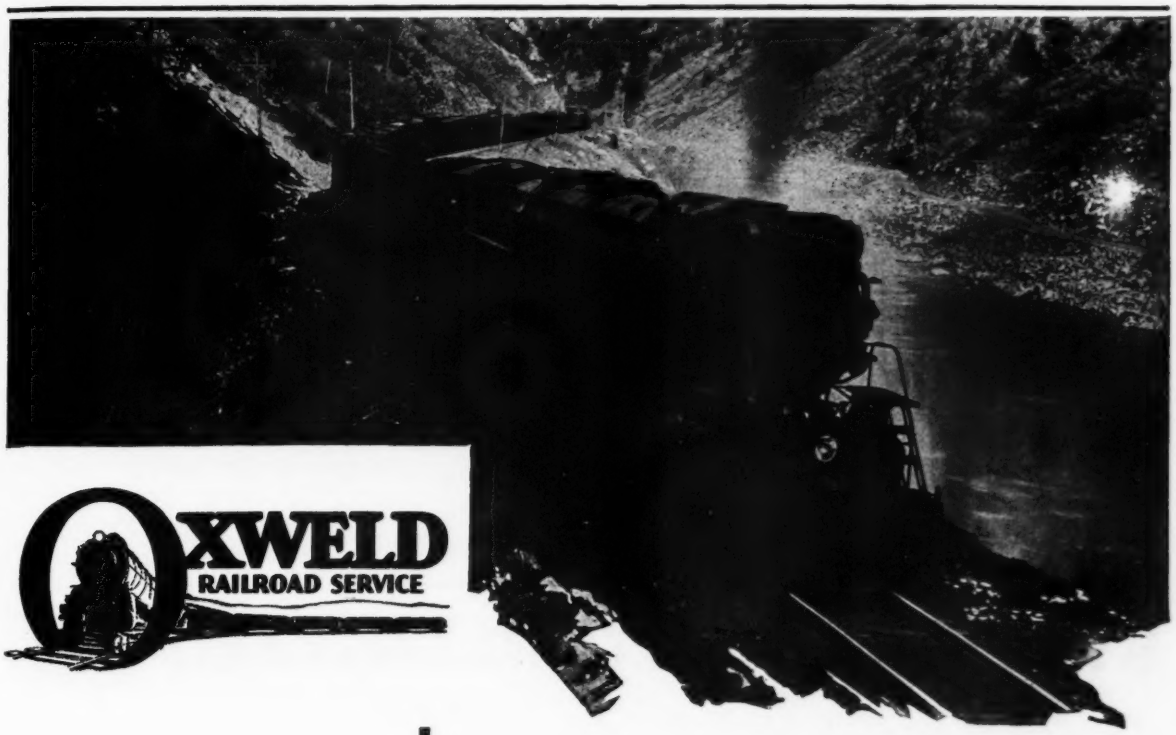


No. 1

MADE of the quality and Craftsmanship to Stand up Under Heavy Blows, Glancing Blows and Misuse is the Quality Found in Woodings Track Chisels and is Recognized by the Men who use them.

WOODINGS FORGE & TOOL CO.
WORKS AND GENERAL OFFICES
VERONA, PENNA.

LONGER–HEAVIER–FASTER TRAINS



IMPROVED condition of track, resulting from modern methods of track maintenance, is one of the prime factors enabling the safe operation of power units of sufficient capacity to handle the longer, heavier trains necessary to take care of increasing freight business. Faster movement of heavy trains materially increases the capacity of the railway plant and is an important contribution toward the betterment of railway earnings.

The Oxweld Railroad Service Company, by supplying the oxwelding needs of a majority of the Class 1 railroads of the country is helping in the constant improvement of maintenance methods.

THE OXWELD RAILROAD SERVICE CO.
Unit of Union Carbide and Carbon Corporation
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NEW YORK CITY
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CHICAGO
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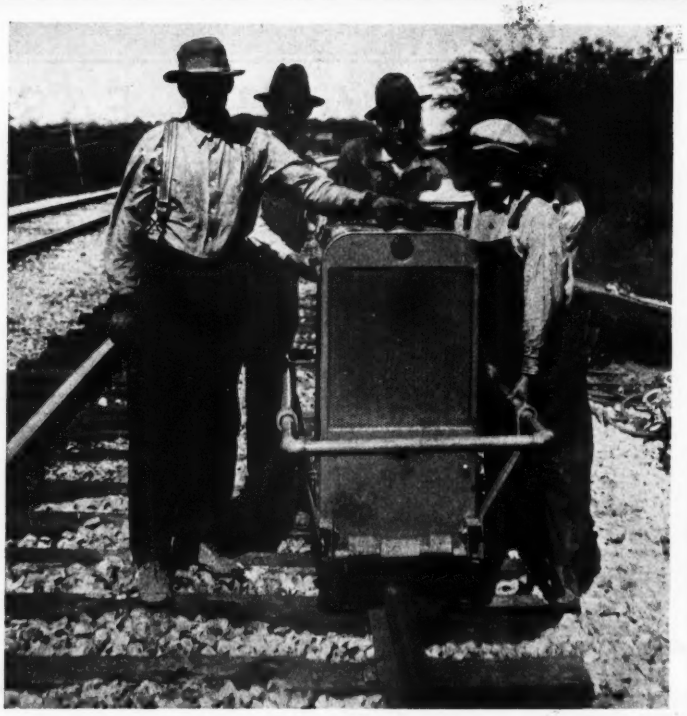

Illustrating how quickly and easily the Syntron power plant can be moved.

SYNTRON ELECTRIC TIE-TAMPERS

Offer

Light, portable power plants
Flexible cable lines
Fast, hard-hitting Tampers
Uniform, long-lasting track
Lower operating and maintenance costs
Plenty of power to operate other track tools, including Arc Welders

◆

SYNTRON

TRACK MAINTENANCE EQUIPMENT

WRITE FOR OUR 1930 CATALOG

SYNTRON COMPANY
400 Lexington Ave. Pittsburgh, Pa.

Millions for maintenance

How much for comfort?

THE railways of America spend countless millions yearly for maintenance, as the annual report of any great trunk line will reveal. Truly a necessary expense if properties are to be maintained at the high standards of excellence so essential to a transportation system. And yet—how much for comfort?

By comfort we mean the little touches that all travelers appreciate. For example, "Standard" Plumbing Fixtures, such as they are accustomed to in their homes. And, if you please, "Standard" Plumbing Fixtures in color on better trains, where de luxe equipment is such an inducement to passenger traffic.

You may not have understood that "Standard" manufactures Plumbing Fixtures for railway use in Ionian Black, Meissen White and eight delightful colors. People of taste and discrimination—the sort of folks who have these charming fixtures in their homes—will be among the first to appreciate the thoughtfulness that lies back of your selection of these new type plumbing fixtures.

May we send you our catalogue and complete details of our service to the world's railways?

Railroad Fixture Department

Standard Sanitary Mfg. Co. PITTSBURGH

Division of

American Radiator and Standard Sanitary Corporation

"Standard" PLUMBING FIXTURES

THE LARGEST MANUFACTURER OF PLUMBING FIXTURES IN THE WORLD

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"THE HOUSE OF TRANSPORTATION"

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ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: A MERRY CHRISTMAS AND A HAPPY NEW YEAR

January 1, 1930

Dear Reader:
Everywhere

By the time this reaches you another holiday season, with its festivities and its joys, will have passed and we will have entered a new year. Although delayed, our greeting to you, our more than 10,000 subscribers and at least twice that number of readers, is no less sincere and hearty. We hope that this holiday season has been one of joy to each of you.

The past year has been a happy one for us. The co-operation that you have extended so generously, by way of information, articles and suggestions, has been most encouraging. The many letters that you have written us, occasionally critical but always constructive, have been stimulating and helpful. Your approval of our efforts, as attested by the unusually high percentage of your subscription renewals, has made us more than ever determined to serve you better during the year now opening. In short, the year has been a happy one for us.

The record of the new year is still to be written. It is our hope that it may be the best for every one of you that you have ever experienced. Our sincere wish is A Happy New Year for you.

A. J. Lacher, Managing Editor
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F. C. Koch, Business Manager
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ON RAILROAD WORK ALL OVER THE WORLD

In the Belgian Congo, in India and Japan - on important railway projects throughout the world, Bucyrus-Erie shovels have been called upon to do the excavating, because of their low cost per yard of dirt moved.

And for maintenance work, the Bucyrus-Erie 2030, Shovel-Crane-Dragline, has been found equally profitable. Because of its speed mobility, ease of conversion and reliable, low-cost operation, it is keyed to the requirements of railroad work.

For work train service and for transporting, the 2030 rides in a drop end gondola without any dismantling. Ask us about it.

BUCYRUS ERIE

BUCYRUS-ERIE COMPANY

Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind.
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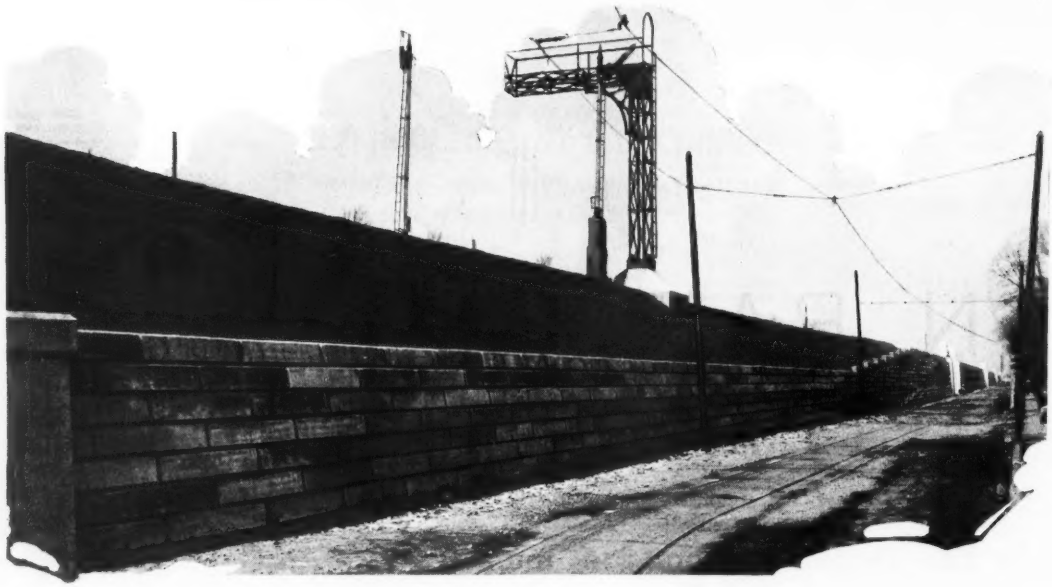
Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco
Representatives throughout the U. S. A. Offices or distributors in all principal countries

A-39-1-30-REM

Power shovels, clamshells, cranes, draglines, dragshovels—½ to 16-yard capacity—electric, steam, gasoline, Diesel, gas air, Diesel air.

Dipper hydraulic and placer mining dredges.



for *Beauty* as well as Utility

Note the Y-shaped headers which interlock with the stretchers, holding the backfill without the use of a third member in the bank. This results in a cellular wall of great strength and with no plane of cleavage in the bank.

A retaining wall along the street can be made attractive —and still meet every other requirement of economy, strength and stability, permanence, freedom from maintenance, quick erection.

Instead of the blank expanse of solid concrete or the unfinished appearance of open-faced cribbing, Federal 2-Piece units present a fine closed-face front, resembling good masonry construction.

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CONTENTS FOR JANUARY, 1930

Editorials 1
1929 a record year; 1930 to be still more active

The Track Motor Car 4
C. R. KNOWLES *tells of its development and the diversity of its applications*

Stronger Frames for Buildings 9
FRANK P. CARTWRIGHT *reports results of tests on various types of wooden structures*

Fighting Snow in Canada 13
C. B. BROWN *tells of methods employed in keeping Canadian National lines open*

New Type of Track Construction 16
Three railways install test sections to verify reports of success in Europe

A Unique Platform Construction 21
Gulf, Mobile & Northern effects economy by using scrap rail in building the supports

The Crosstie in Canada 22
G. P. MACLAREN *describes the practices of Canadian National in their preservation*

Train Derailed by Flood Water 23
Bureau of Safety reports on fatal accident on Rock Island bridge in Colorado

The I. C. C. Consolidation Report 25
Abstract of the commission's plan for combining the railways into 21 systems

Three Railways Award Prizes 26
Reports of results on Canadian Pacific, the Lehigh Valley and the Norfolk & Western

What's the Answer 27

New and Improved Devices 35

What Our Readers Think 37

With the Associations 38

Railway News Briefly Told 40

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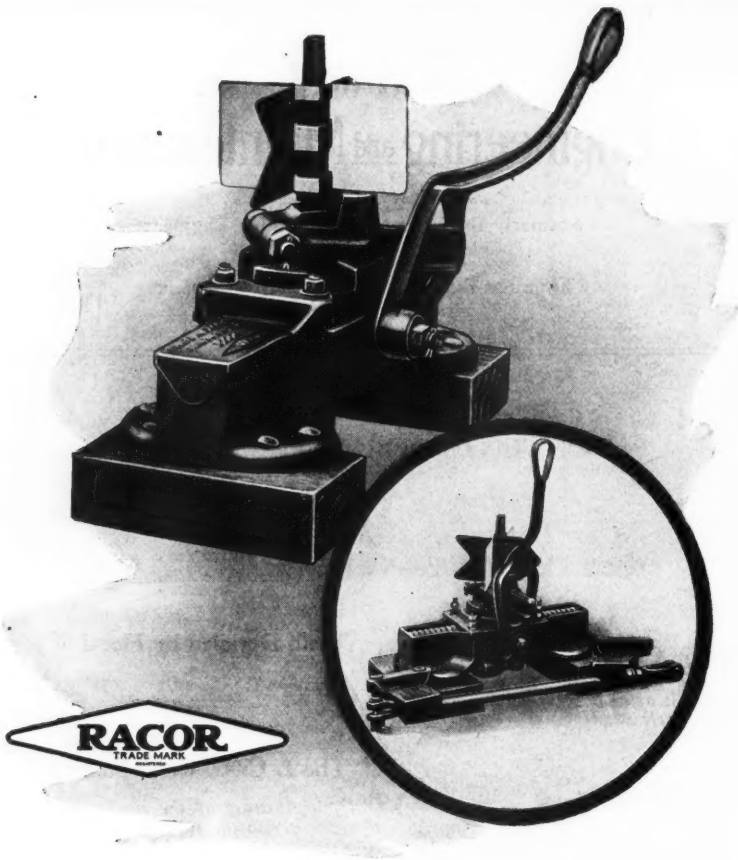

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Railway Engineering and Maintenance

Volume 26 January, 1930 No. 1

1929 a Record Year; 1930 to Be Still More Active

THE YEAR 1929 was one of distinct achievement for the railways. This was particularly true of the engineering and maintenance of way departments. Not only was the improvement program markedly larger than during either of the two preceding years but the expenditures for the current repair of the roadway properties was on an equally liberal scale. The year was characterized further by unusual freedom from floods, labor disturbances and other adverse influences. As a result, the amount of constructive work done on the properties was unusually large, and they enter the new year better able to cope with a heavy traffic economically and efficiently than ever before. This excellent condition of the railways was recognized by President Hoover in his recent message to Congress in which he stated that "The railroads were never in such good physical condition and the country has never been so well served by them."

During 1929, traffic moved in greater volume than ever before, while the net earnings established a new high record. As a result, the rate of return on property investment increased to 4.97 per cent, as compared with 4.71 per cent in 1928, and approximated the 4.98 per cent earned in 1926, the best previous year. It was, however, still considerably below the 5.75 per cent which the Interstate Commerce Commission fixed as a fair return several years ago.

While the volume of traffic handled in 1929 exceeded that in the previous year, the trend differed widely. The year 1928 opened with a smaller movement of traffic than that of the corresponding period of the preceding year, a condition which prevailed until mid-summer when the trend turned upward for the remainder of the year. The momentum of this movement carried over into 1929, with the result that gains were recorded for every month until September. In October, a downward tendency became evident and this has continued to the present time. The movement for the first three quarters of the year was so great, however, that the volume of traffic for the year, measured in ton miles, exceeded slightly the previous high record established in 1926.

Car loadings for 1929 approximated 52,800,000, an average of 1,015,000 per week. This compares with an average weekly figure of 992,000 in 1928 and of 1,021,000 in 1926, the only other year in which the average exceeded a million cars loaded per week for an entire year. There were 28 weeks in 1929 in which the loadings exceeded a million per week.

Passenger traffic continued to decline, although at a lower rate than in 1928, the loss for the year being 1.4 per cent. The volume was smaller than in any year since 1908 while the total decline from the peak of 1920 was 33.6 per cent. This traffic was handled with an efficiency never before attained, high points in this record appearing in the box on this page. This traffic was handled without congestion or appreciable shortage of equipment.

In 1929

The average movement per car per day was greater than in any previous year, the average of 36.3 miles for October being the greatest for any single month on record.

Fewer trains and locomotives, in proportion to the amount of traffic hauled, were required than ever before.

The average load per train was the highest ever reported.

Freight traffic was handled with the greatest conservation of fuel ever reported.

The number of tons of freight moved one mile by a train per hour was greater than ever before.

The average movement per freight train per hour exceeded all previous marks.

The total operating revenues for the year amounted to $6,354,000,000, an increase of $176,000,000, or 2.8 per cent over 1928. Total operating expenses aggregated $4,538,000,000, or $65,000,000 more than in the preceding year. Net operating income aggregated $1,227,000,000, or $84,000,000 more than in 1928. The operating ratio was 71.4, the lowest since 1917.

An outstanding feature of the year's financial results was the marked increase in taxes. The total expenditure for this purpose aggregated $420,000,000 in 1929 or $25,000,000 more than in the preceding year. A total of 6.6 cents out of every dollar of operating revenues of the railways was paid out in taxes during 1929.

The high character of service rendered, together with the decrease effected in the operating ratio and the increase in net earnings, were made possible very largely by the large expenditures during 1929 and preceding years for the enlargement, improvement and strengthening of the roadway properties. Delays have been relieved by means of added or enlarged facilities at points of congestion, slow orders and derailments have been reduced by the building of a stronger track, more modern buildings have lowered the cost of maintenance, etc. It is largely by reason of the liberal program of improvements of this character that the average speed of freight trains has been increased from 10.8 miles in 1923 to 13.1 miles during the first 10 months of 1929, while the gross tons per freight train increased from 1,539 to 1,877. The result has been an increase in gross ton-miles per freight

train hour from 16,764 in 1923 to 24,628 in 1929.

The year was noteworthy by reason of the magnitude of the expenditures for improvements. Approximately $800,000,000 was expended for additions and betterments during the year, as contrasted with $676,665,000 in 1928 and an annual average of $770,000,000 during the years 1925-1928, inclusive. Of the amount expended last year, approximately $500,000,000 went for roadway improvements as contrasted with $300,000,000 for equipment, thus indicating a deviation from the trend, which has been so marked during the last few years, of devoting increasing proportions of the appropriations to roadway improvements. This division is shown by the following figures:

Year	Total Capital Expenditures	Expenditures for Equipment	Per Cent of Total	Expenditures for Roadway	Per Cent of Total
1923	$1,059,149,426	$681,723,991	64	$377,425,435	36
1924	874,743,228	493,608,460	56	381,134,768	44
1925	784,191,000	338,114,000	45	410,077,000	55
1926	875,000,000	380,000,000	43	495,000,000	57
1927	771,552,000	288,700,000	37	482,852,000	63
1928	676,665,000	224,301,000	33	452,364,000	67
1929*	800,000,000	300,000,000	37	500,000,000	63

*Last Three Months Estimated.

The mileage of new lines complete during 1929 totaled 666 as compared with 1,025 during the preceding year, a decrease of 359 miles or 35 per cent. The mileage built in 1929 was less than for any year since 1926 although larger than any year between 1919 and 1926. At the close of the year, however, 630 miles of new lines were still under construction while 1,186 miles of additional lines were authorized, under survey or projected by existing companies and 2,333 miles more were contemplated by other companies.

For the second consecutive year Texas led other states with 159 miles of lines completed, while California was second with 114 miles. Among the longer lines placed in service were those of the Southern Pacific between Klamath Falls, Ore., and Alturas, Cal., 95.4 miles, and of the Atchison, Topeka & Santa Fe between Pampa, Tex., and Cheyenne, Okla., 80.5 miles, and the cutoff of the Detroit, Toledo & Ironton between Petersburg, Mich., and Malinta, Ohio, 46.5 miles.

Less Second Track

The mileage of second track completed also showed a marked decline, 181 miles being placed in service last year as compared with 271 miles in 1928. Thus, there has been a continuation of a decline in second-track construction that has been brought about primarily by the increased use of automatic signals, centralized dispatching, remote control of power switches and other measures which permit the more intensive use of existing facilities. The Southern Pacific led the country in second-track construction with 32 miles, followed by the Great Northern with 25.7 miles and the Texas & Pacific with 22 miles.

Included in the expenditures for roadway improvements were appropriations for the wide diversity of facilities entering into a composite railway property. The Pennsylvania is engaged in the electrification of its main line between New York and Philadelphia and in the reconstruction of its passenger terminal in the latter city, which projects will cost upwards of $150,000,000. The Reading is likewise engaged in electrifying suburban lines leading out of Philadelphia which, together with grade separation and track changes will cost approximately $20,000,000. A third large electrification project on which work is actively under way is that of the Lackawanna in its suburban territory in the vicinity of New York City.

The largest single project which was undertaken during the year was the west-side improvement of the New York Central in New York City, which involves an ultimate expenditure of approximately $175,000,000 for the elevation and relocation of its freight tracks on Manhattan Island.

A total of 475 miles of lines were abandoned during the year, as compared with 512 miles in 1928. The largest mileage abandoned by any one road was by the Santa Fe with 80 miles in three sections, while the Southern Pacific was second with 54 miles in four sections. The largest single abandonment was that of the Nashville, Chattanooga & St. Louis between Fayetteville, Tenn., and Capshaw, Ala., 37 miles.

The continuing appreciation by railway managements of the value of signaling facilities in expediting the movement of trains and increasing the capacity of lines is shown by the expenditures made for equipment of this character. Automatic block signals were completed on 4,785 miles of lines last year, as compared with 3,121 in 1928 and a 10-year average of 2,505. The combination of signaling and interlocking, including the application of power switch machines for the operation of passing track and junction switches, together with controlled signals for directing train movements, showed a marked increase, more than 122 installations being made during 1929.

Large Expenditures for Equipment

The increasingly large appropriations for equipment are reflected in the orders that were placed during the year for freight and passenger cars and for locomotives, and also in the number of units of equipment built and delivered. The roads of the United States ordered 1,212 locomotives last year, as compared with 603 in 1928. Canadian roads ordered 77 locomotives last year and 98 the preceding year, while 106 were ordered by foreign railways as compared with 27 in 1928, or a total of 1,395 in 1929 as contrasted with 728 the preceding year.

The railways of the United States ordered 111,218 freight cars last year, a larger number than in any year since 1924 and more than twice the 51,200 ordered in 1928. Canadian roads ordered 9,899 freight cars last year or more than in any year since 1920, while 3,023 were ordered for export as compared with 2,530 in 1928, or a total of orders from all sources of 124,140 as compared with 62,631 in 1928.

The lines of the United States also ordered 2,299 passenger cars last year or slightly more than the 1,930 ordered the previous year. This number was, however, the largest, with two exceptions, since 1916. In Canada 122 passenger cars were ordered as contrasted with 334 in 1928, while 33 passenger cars were ordered by foreign railways in comparison with 29 the preceding year, or a combined total of 2,431 as contrasted with 2,293 in 1928.

An Active Maintenance Year

The expenditures for the maintenance of roadway facilities were likewise on a more liberal scale last year than in 1928. For the first 10 months they totaled $734,704,749 or 2.3 per cent larger than for the corresponding period of the previous year, while for the entire year they are estimated at $860,000,000 or about $15,000,000 more than in 1928. With the single exception of 1927, the expenditures were larger than for any year since 1920. Measured in another way the ratio of maintenance of way expenses to total operating expenses for 1929 will approximate 19 per cent as contrasted with 16.6 per cent in 1923.

As these large scale expenditures of 1929 complete

a five-year period of the most uniform and heavy outlay for roadway maintenance in the history of the American railways, it is evident that no part of the outlay for 1929 went to make good deferred maintenance. Rather it has gone for better ditching, the renewal of ballast, the restoration of roadbed shoulders, the replacement of rail, the maintenance of better line and surface and other details which go to make better track and structures.

No Labor Troubles

The supply of labor was adequate for the needs of the roads in practically all parts of the country. Like the years immediately preceding, there was little unrest among the forces and the turnover was low, with the result that the efficiency of the forces compared favorably with that of recent years. The higher wage rates which have prevailed during the last few years have tended to draw more men from the local communities, which in itself has tended to stabilize employment and raise the standard of the forces.

In one respect—that of more uniform employment throughout the year—progress has been slight. Some roads are making a serious effort to stabilize their forces throughout the year by transferring such operations as laying of rail from the summer to the winter months, as is shown by the fact that orders for more than 1,500,000 tons of rails were placed before December 1 last. However, the fluctuations between winter and summer forces have shown little or no tendency to decrease in the last eight years and the spread between the maximum summer force and the minimum winter force continues to approximate 125,000.

Labor Saving Equipment

Of special interest is the attention which railway managements have continued to give in the utilization of equipment to reduce the drudgery of maintenance work. Equipment of demonstrated practicability has met with increasing adaptation during the year, while numerous new devices have been introduced and improvements have been made in others. A single road placed orders for more than a million dollars worth of equipment of this character during the last year, including such diverse units as tie tampers, ballast cleaners, spreaders, cranes and motor trucks. Indicative also of the trend of the times is the purchase by one road of a single unit of labor-saving equipment costing more than $100,000.

Other Forms of Transportation

Of special interest during the year was the increasing use made by the railways of the newer forms of transportation—notably by highway and air. Although the roads gave almost no attention to motor transportation prior to 1925, at least 78 roads are now operating a total of more than 2,400 motor coaches and 55 roads are operating, directly or by contract, more than 5,900 trucks. Furthermore, the number of buses operated by the railways more than doubled during the last year.

In air transportation, the outstanding development was the inauguration of the first transcontinental rail-plane service, involving the use of both trains and airplanes, by the Pennsylvania-Transcontinental Air Transport-Santa Fe route, shortening the journey from New York to Los Angeles to two days, or 1½ days less than the all-rail time. Other transcontinental as well as shorter routes are now operating on schedules co-ordinating train and air service, with joint ticketing arrangements.

In Canada and Mexico

In Canada, the year has been one of more marked contrasts. In construction, the roads completed 841 miles of new lines as compared with 722 miles in the previous year and 666 in the United States, this being the third year in history in which the mileage built in Canada has exceeded that completed in the States.

In maintenance, the activity was less marked, particularly in the closing months of the year. Following a period of heavy traffic in 1928, the roads undertook liberal programs of maintenance last spring, but these programs were curtailed sharply in the fall following the partial loss of the grain crop and the consequent drastic decline in earnings. The outlook is, however, for a better year in this respect in 1930.

In Mexico, the railways are gradually emerging from the period of instability and destruction that arrested all progress during the period of revolutions since 1913. While the outbreak of last spring resulted in the destruction of much railroad property, it was defeated so decisively that conditions in that country are now more stable than at any time since the days of Diaz.

The Outlook for 1930

Although the year which has just closed has been one of unusual activity, the indications are that 1930 will witness greater progress. Data collected by the Railway Age from 40 railways comprising nearly half the mileage of the United States, Canada and Mexico, shows that the roads of North America will spend $1,200,000,000 for new equipment and for additions and betterments chargeable to capital account during 1930, of which amount the railways of the United States alone will spend $1,050,000,000 or over 25 per cent more than in 1929. This amount will exceed that of any year in history with the possible exception of 1923, when the railways of the United States expended $1,059,149,000 for this purpose. By way of further comparison, 30 roads whose figures are included in the above totals also furnished similar data as to their budgets of a year ago, and a comparison of these budgets for the two years shows that the plans for 1930 contemplate the expenditure of over 22 per cent more money than the same roads planned for 1929.

An analysis of these budgets indicates that 41 per cent of the appropriations will go for equipment, as compared with 59 per cent for roadway, a continuation of the trend towards larger expenditures for cars and locomotives, to which attention has already been called. Notwithstanding this fact, however, the appropriations for capital expenditures are so great that the amount set aside for roadway improvements will exceed that for 1929 by at least 15 per cent. Since the last year was one of unusually large expenditures for improvements to tracks and structures, the indications are that 1930 will set a new high mark for capital expenditures of this character. Furthermore, since such expenditures afford an index to the expenditures for the current upkeep of the properties, particularly because many improvements involve charges to both operating and capital accounts, it may reasonably be expected that the expenditures for maintenance will be equally liberal.

A Heavy-duty Car Hauling an Extra Gang of 50 Men.

The Track Motor Car

*Its Place in Railway Work**

The development of this standard unit of equipment—the diversity of its applications

By C. R. KNOWLES †

THE track motor car provides the means of transporting a third of a million men to and from work daily together with their tools and equipment. It also provides an efficient and economical means of inspecting track and structures. By reason of these services it has become one of the most important auxiliaries to modern railway maintenance.

Although the first motor car was built more than thirty years ago it has been in the process of development until within the last few years. As an example, one of the leading manufacturers of motor cars built more than sixty different types before finally concentrating on four models. This experimental period is now past and the construction of motor cars is on a permanent basis. While there will continue to be improvements, it is unlikely that there will be any radical departure from the present general design, particularly in section and similar types, as the cars now being built meet the requirements satisfactorily. As the uses of the motor car are further developed they will undoubtedly call for additional types or models suited to particular requirements. This may not require different sizes of engines as much as special sizes and types of frames and bodies, which will possibly increase the number of common types of cars to seven or eight.

The motor car is not only widely used on railroads at the present time but its use is being constantly extended. For this reason the proper operation and maintenance of motor cars is a problem of increasing importance to every maintenance officer.

This is the first of a series of articles on the care and operation of motor cars which will appear serially in Railway Engineering and Maintenance during 1930. The following articles in this series will treat of types of motor cars, motor car engines, design and construction, lubrication, ignition, efficient operation, safe operation, field and shop maintenance, organization for maintenance, and cost of operation and economy.

The author has long been recognized as an authority on railway water service problems, and several years ago his duties were extended to include supervision over all phases of railway work equipment. His standing in this newer field is indicated by the fact that he has been selected by the American Railway Engineering Association to direct the work of its newly-organized Committee on Work Equipment.

Historical

Although the gasoline-propelled track motor car is of comparatively recent development, it has become so well established that it is now almost universally recognized as a necessity for the rapid and economical movement of men, tools and materials. This is particularly true of the maintenance of way department and to a large extent also of the signal, telegraph and other departments. While the principal field for the motor car is, and probably always will be, in maintenance work, its use is being constantly extended to other departments and other purposes. Although the adoption of motor cars for general service has been slow on some railroads, there is hardly any road that does not now use

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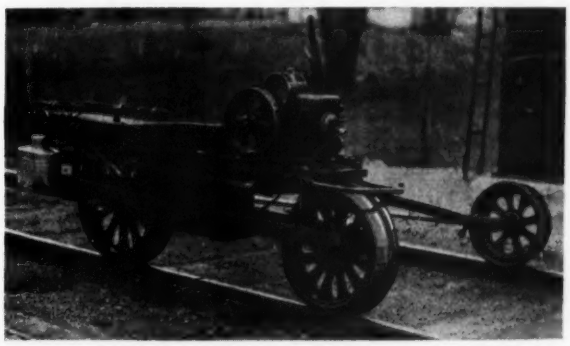
†Mr. Knowles is in charge of work equipment on the Illinois Central System.

them to some extent, and a large number of railroads have completely equipped their lines with motor cars wherever they may be used to advantage.

The earlier types of motor cars were not altogether reliable in operation, chiefly because of the uncertainty of operation of the engine and the necessity for providing skilled operators to run them. However, the development of the gasoline engine in recent years, together with improvements in the car itself, have been such as to make the motor car a very dependable unit, with the result that it is now being employed successfully by operators who have little or no mechanical ability or knowledge of the construction of the car or engine.

The modern motor car is an outgrowth of the push car, which, as its name indicates, was first propelled along the track by men walking beside the car or by poles shoved against the ends of ties by the men who stood or sat upon the car. The next development was to equip the car with a crank and gears, the crank being turned by two men. This method was further improved by the installation of two pulleys, one on the crank shaft and another on the axle of the car, the power being transmitted to the axle by a belt. The objection to this method of propelling the car was that only two men could work at the cranks at a time. As a result, the idea of the walking beam was borrowed from the old town fire pump, the power being transmitted to the axle by means of a crank and gear which engaged a smaller gear on the axle. Out of this came the hand or lever



One of the First Engines Installed on a Velocipede Car.

car which was a decided improvement over earlier methods of propulsion, as it not only permitted the entire gang to work at the levers but effected a marked increase in speed. This lever car, with but few modifications of the original design, is still used to a limited extent, where motor cars have not yet been furnished as regular equipment.

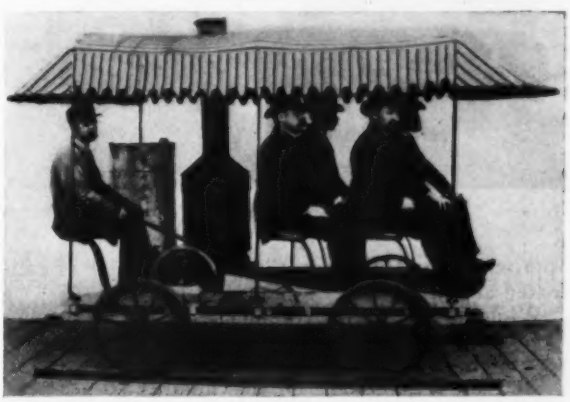
Development of the Motor Car

The development of the track motor car has come about as a result of the demand for increased efficiency in maintenance of way work, through decreasing the time spent by employees in traveling over the tracks on duty. This development was influenced to no small extent by the attitude of the employees themselves, for while the lever car was an improvement over former methods of transporting men and tools to and from the work, it still left much to be desired, and it was apparent that if the desired result was to be obtained, from the standpoints of both greater efficiency and less arduous labor, a motive force other than man power would

An Early Engine Designed for Installation on a Hand Car.

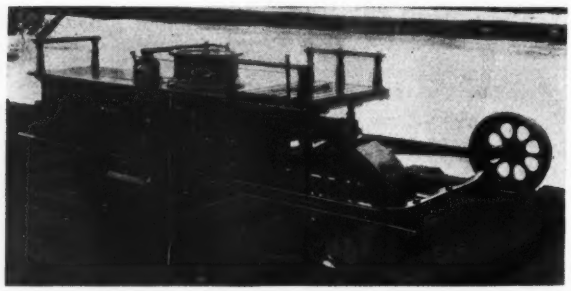
have to be employed. This led to the application of small gasoline engines to push cars, with the power applied to the axle by means of pulleys and a belt. The first gasoline-propelled cars were not always reliable and required considerable skill as well as patience in their operation, but the idea met with popular favor and manufacturers began to build small engines for hand and push cars, followed with complete motor cars.

The first complete motor cars built were of the side-load type, designed to carry one or two men and were first used as inspection cars. As the practicability of these light cars was demonstrated, larger ones were built to carry a greater number of men, and, like the side-load car, they were first used primarily for inspection rather than general service. These cars were rather crude in design and operation as compared to the modern motor car. This was particularly true of the engine and methods of carburetion and ignition. The engines were of the four-cycle type, nearly all of which were air cooled. As the carburetor, induction coil and spark plug



One of the Earliest Motor Cars, with a Steam Engine and Boiler.

were still in the process of development, the mixing of air and fuel was accomplished by means of a small tank and mixing valve which were the forerunner of the modern carburetor. Much of the engine trouble experienced with the earlier type of cars was due to the difficulty in maintaining the proper mixture of air and gasoline. The ignition was also more or less crude and, together with the uncertainty of



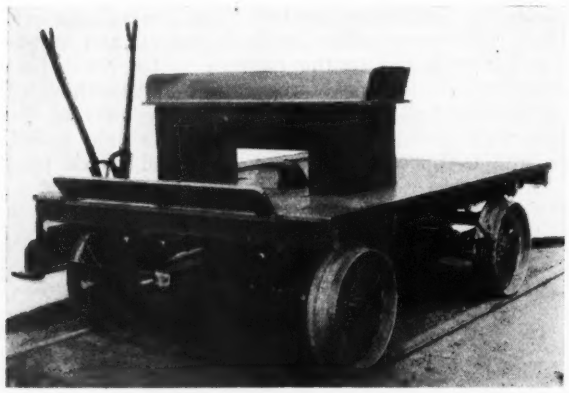
One of the First Complete Light Inspection Cars.

the fuel mixture, the continued operation of the cars was somewhat of a problem, even in the hands of an experienced operator.

The adoption of the motor car for general service necessarily progressed slowly until these difficulties had been overcome and the cars had been made more reliable in operation in the hands of unskilled operators. The period from 1896, when the first complete motor car was produced, until about 1910 was one of marked development, particularly in the engine, the two-cycle engine being developed and brought into general use during this period.

Extent of Use of Cars

The demand for cars increased as their economy was demonstrated and the manufacturers developed engines and motor cars specially designed to meet the varied needs of the railroads, until at least six large companies are now engaged in their manufacture. The purchase of motor cars in 1928 aggregated



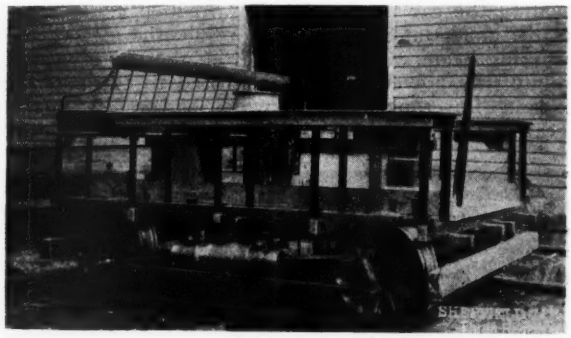
A Pioneer Heavy-Duty Car.

approximately 4,800 cars, the value of which is estimated at $1,200,000.

While no figures are available as to the total number of motor cars in service, it is estimated to approximate 60,000, representing a total investment of more than $12,000,000. Of this number 70 per cent, or 42,000 cars, are in maintenance of way service and 18,000, or 30 per cent, are employed for miscellaneous purposes, such as telegraph, inspection, hump yard, car repairers' and similar service. The total number of cars in use is being increased at the rate of about 2,000 per year, while 2,800 of the cars purchased annually go for the replacement of obsolete or worn out cars and those damaged beyond economical repair.

The present rate of replacement of worn out and obsolete cars indicates an average life of more than 20 years. The rate of renewal will undoubtedly increase, however, for the economical life of a motor car is from 8 to 10 years. This is, of course, an average figure for certain cars may show a longer life while it may prove economical to retire others within a shorter time.

It is difficult to estimate with any degree of accuracy when the saturation point of motor cars will be reached, or in other words when the number of motor cars in operation will equal the number that the railways can justify economically. On the basis of the present uses, approximately 80,000 cars would be required to equip all roads in the United States and Canada to this point. This is probably a conservative figure for, with the further development of



One of the First Complete Section Work Cars Ever Built.

motor cars, other uses will be found for them and the number required will no doubt be materially increased.

Motor Cars in Track Work

The classes of work in the maintenance of way department in which motor cars are employed include almost every operation in the conduct of the work of maintaining tracks and structures. Their principal field is in track work, not only for regular section gangs engaged in the routine work of maintenance but also in extra gang and construction service. It is estimated that 70 per cent of all motor cars used are engaged in this class of service.

It is generally agreed that the motor car will save an hour each day for the men and foreman on the average section. This is of increasing importance with the eight-hour day as it represents a saving in time of 12½ per cent. In addition, the efficiency of the men is increased by reason of the fact that practically no exertion is required of them in the operation of the car, and as a result their full energy is available for the work in hand. It is also possible to secure and hold a better class of men where motor cars are used. The motor car also permits a foreman to get over his track at more frequent intervals. Another advantage is the convenience and speed with which gangs may be mobilized for emergency or other work. It is of decided advantage in enabling

a gang to get to an accident or washout promptly. It is of particular value in permitting a gang to get over its track quickly after a storm, thus reducing delays to trains and the possibility of accidents.

Handling material is another function of the motor car that adds to its value, as it can be used in distributing ties, rails, tie plates, crossing plank, angle bars, spikes and many other materials used in main-

Large Party Inspection Car.

tenance work. The motor car can be used with a trailer for the distribution of ties, either from piles at section headquarters or where they are unloaded from local freight trains, thus eliminating the necessity for using work trains for such work.

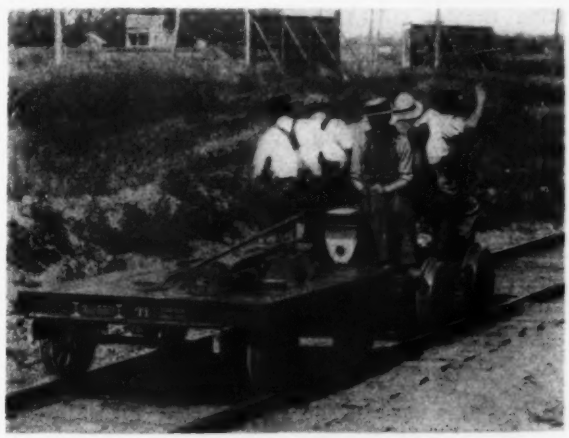
The use of motor cars is of particular value with extra gangs both in handling men and materials. This is especially true in handling men as it eliminates the necessity of sending the men on regular trains whose schedules may not be adapted to the working hours, and delivers them to the job without an extra stop for the train. The use of motor cars also makes it possible in many cases to select better

A One-man Telegraph Lineman's Car.

camp sites. Motor cars of the heavy-duty type are well adapted to extra-gang service as they will easily haul 5 or 6 trailers and transport from 100 to 125 men. The time saved with extra gangs is much greater than in section service, both on account of longer hauls and more men. Extra gangs rarely consist of less than 20 to 25 men, and frequently number 50 to 100. The time saved through the use of motor cars is from 1½ to 2 hours per day. For a gang of 50 men, the time saved aggregates from 75 to 100 man hours per day, or 9 to 12 men. Where the work train is eliminated through the use of the motor car there is a saving not only of the time of the men, that may be lost, but of the cost of work train service as well.

Bridge and Signal Uses

The number of motor cars employed in the maintenance of bridges and signals is second only to the number used in the maintenance of track, and about equally divided between the two classes of service. The requirements in a motor car for bridge gang use are somewhat different than for a section gang as the distances covered are greater; as a rule a bridge gang car must also haul heavier and more bulky loads, as for example long bridge timbers. While the ordinary section car is frequently used in this class of service, most bridge gangs require a heavier car, similar to those designed for extra gang service. It should be equipped with a free running engine and should be capable of hauling at least two trailers.



A Modern Section Motor Car with Trailer.

The saving in time can be conservatively estimated at two hours a day, or 25 per cent, based upon the eight-hour day.

Signal maintainers can cover more territory and take care of a greater number of signals by the use of a motor car than would be possible in any other way. The so-called light inspection car used in this service also carries battery renewals, distilled water and light repair parts. By reason of the work it performs, it is really a light work car. Cars used by water service repairmen and telegraph linemen are of the same type and are used in similar service. It is difficult to place a definite value upon the work performed by these cars but it is safe to say that the return on the investment equals that on the larger cars.

Miscellaneous Applications

One of the problems in the operation of hump yards employing car riders is to return the car riders to the hump as quickly as possible. The motor car has proven the most satisfactory and economical method of performing this task. Heavy duty cars are used in this class of service, equipped with foot boards in addition to the deck and seat used on roadway maintenance cars. These foot boards permit the riders to board the cars while in motion and also

form a foot rest for men seated on the deck of the car. From 10 to 15 men ride the car on each trip. Without motor cars, the logical means of transporting the car riders would be through the use of a locomotive and trailer car. Therefore, the saving by using motor cars is equivalent to the cost of operating a locomotive from one to three shifts per day, depending upon the number of hours the hump is in operation.

Motor cars are used in hauling employees to and from isolated shops and yards where other means of transportation are not available. They are also used extensively by car repairers in handling men, tools and repairs. Stores departments are using motor cars for checking line stock and also for handling materials. One road has installed four cars for this latter purpose at one of its storehouses, using cars equipped with automobile engines and operating on a narrow-gage track. Motor cars are also being used to pull mowing machines, weed burners and discing machines and to drive rail saws, track drills, grinders and tie tampers.

Self-contained paint spray outfits mounted on motor cars and utilizing the same engine for operating the air compressor and driving the car are coming into extensive use, providing a means of transporting the paint gang and equipment as well as furnishing air for spray painting. Power cars are also built with auxiliary electric generators or air compressors for driving various tools used in maintenance of way work.

The use of the motor car in inspection service is practically universal, even on those railroads that have not yet admitted its value for general service. Inspection cars are confined largely to two classes of service; namely, that requiring a small car capable of carrying one or two men and used in bridge in-

A Light Work Car for a Signal or Water Works' Gang.

spection, by roadmasters and track inspectors; and the larger party inspection cars, the seating capacity of which varies from 6 to 15 persons and designed for general use on divisions or grand divisions. Division inspection cars usually have a seating capacity of 6 to 8 persons and are capable of transporting the division superintendent and his staff. General inspection trips over several divisions usually demand a larger car with additional seating capacity.

These larger cars are equipped with engines of from 25 to 112 hp. and will attain a speed as high as 50 miles per hour. In many instances they replace the division superintendents' business car or a special train such as was frequently operated for the purpose of making inspections. The advantages of motor cars for inspection service, by reason of the time saved in covering a given distance, are so apparent that it is hardly necessary to offer any comments.

A Substitute for Work-Train Service

The motor car has been in use for such a comparatively short time and has developed so rapidly that it is almost impossible to make an accurate prediction as to the possibilities and future direction of

Motor Car with Ballast Discer Attachment

development, but there is no doubt that as it is further developed it will have a wider scope of use, particularly in maintenance of way work. Furthermore, as more powerful cars are produced it is safe to predict that they will take the place of the work train to a large extent.

While it is not to be expected that the motor car will entirely displace the work train, it has already become a factor in reducing the number of such trains required. This is particularly true of its use in transporting men to and from a job and also in some cases in handling material, as for example in distributing ties. The cost of work-train service has increased greatly in recent years, and it is difficult to justify its expense in handling men alone. The motor car has solved the problem of getting men to the job, and, in addition to reducing the expense for such service, has eliminated much of the delay incident to running work trains to sidings to clear regular trains, as the motor car can be set off at almost any point on the right of way. It can often get to a job ahead of a regular train when it would not be expedient to send the work train out until after the train had passed. Another feature of economy in favor of the motor car is the fact that no expense accrues except during the time that the car is actually in operation, while work train expense goes on whether it is actually at work or on a siding.

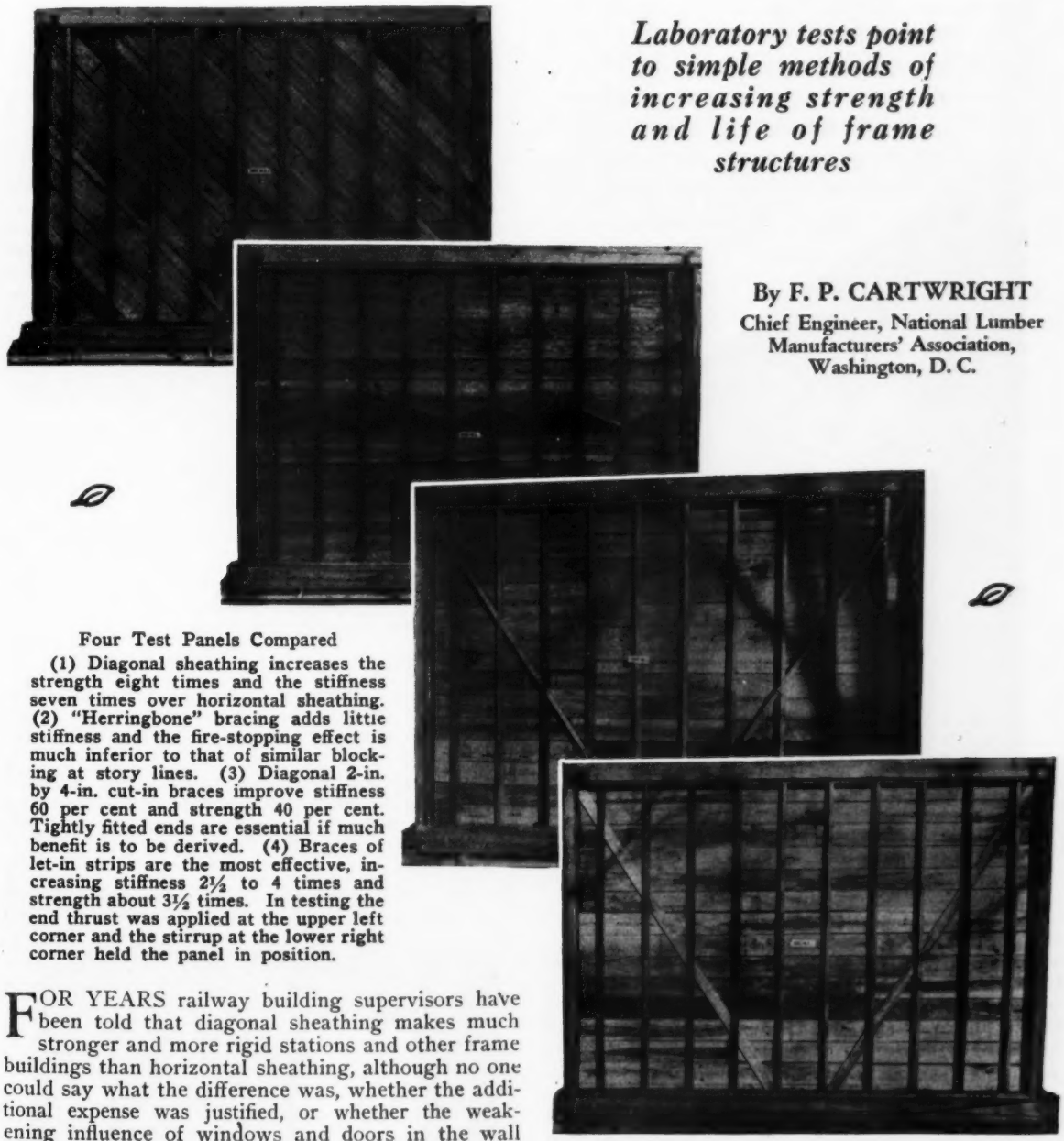
Every work train taken off the road makes for efficiency. The motor car will do more toward reducing work-train mileage than any other agency. This is shown by the fact that the average annual work train mileage on Class 1 railroads was reduced from 46,911,000 for the five years from 1911 to 1915 inclusive, to 35,362,000 for the five-year period ending with 1927, an average annual reduction of 11,549,000 work train miles, much of which can be credited to the increasing use of motor cars.

The fact that the majority of motor cars have to be made light enough to enable them to be removed readily from the track will always limit the size and weight of cars for use in ordinary maintenance of way work. Even with these limitations, the ordinary section car will readily handle two trailers and carry 30 men or 60 ties over the average railroad.

Much Stronger Buildings at Little Extra Cost

Laboratory tests point to simple methods of increasing strength and life of frame structures

By F. P. CARTWRIGHT
Chief Engineer, National Lumber Manufacturers' Association, Washington, D. C.



Four Test Panels Compared

(1) Diagonal sheathing increases the strength eight times and the stiffness seven times over horizontal sheathing. (2) "Herringbone" bracing adds little stiffness and the fire-stopping effect is much inferior to that of similar blocking at story lines. (3) Diagonal 2-in. by 4-in. cut-in braces improve stiffness 60 per cent and strength 40 per cent. Tightly fitted ends are essential if much benefit is to be derived. (4) Braces of let-in strips are the most effective, increasing stiffness 2½ to 4 times and strength about 3½ times. In testing the end thrust was applied at the upper left corner and the stirrup at the lower right corner held the panel in position.

FOR YEARS railway building supervisors have been told that diagonal sheathing makes much stronger and more rigid stations and other frame buildings than horizontal sheathing, although no one could say what the difference was, whether the additional expense was justified, or whether the weakening influence of windows and doors in the wall offset the benefits of diagonal sheathing. Are diagonal strips, let in to the studs, better or poorer bracing than 2-ft. by 4-ft. corner braces cut in between studs, or herringbone bridging at half-story heights? Do three nails in each board make a wall stronger and more rigid than two nails?

These and many other questions have confronted master carpenters and supervisors of buildings, architects and engineers charged with the construction of a strong, rigid and permanent frame structure. They have been given emphasis in the last few years by tornadoes and hurricanes, which alone have wrecked thousands of buildings of both frame and masonry construction, and by earthquake insurance rates which in some parts of the country far exceed those for fire.

Definite answers to these questions are given by a series of tests just completed at the United States Forest Products Laboratory, Madison, Wis. After prefacing its work by personal investigations in a number of storm-damaged areas, the laboratory de-

cided that the walls contribute most to the strength and rigidity of the building as a whole. It was also determined that typical, lumber framed and sheathed walls are strong enough to resist any pressure likely to be caused by wind blowing directly against them, the more critical point being that of wall resistance to end thrust, caused when the pressure against the front is transmitted to the side walls.

With this in mind, the Laboratory built and subjected to end thrust nearly fifty frame walls of full story height and long enough to determine how a real wall would act under extreme conditions. They were 8 and 9 ft. high and 12 and 14 ft. long and were framed with 2-ft. by 4-ft. timbers at the usual 16-in. spacing. The sole plate or sill was bolted to a fixed base and end posts, corresponding to the corner posts of a house, were built up in the usual way, using three 2-ft. by 4-ft. timbers. The pressure was applied horizontally at the top plate in the plane of the wall surface.

View of panel diagonally sheathed with green lumber and allowed to season one month. Stiffness reduced 55 per cent.

Measurements were taken to determine the rigidity of the walls, as shown by the end thrust necessary to cause a given movement of the end posts from their upright position, and the strength, which was the end thrust necessary to cause failure of the whole panel. The results are better understood by taking the average strength and stiffness of a double-nailed horizontally sheathed panel as a basis and calling it (1). The strength of a diagonally sheathed panel is then about (8), or eight times as much. If the stiffness of the horizontally sheathed panel is also taken as (1), that of the diagonally sheathed panel with the force applied so that the boards are in compression is about (7). The tests covered the following principal factors affecting strength and rigidity of light framing.

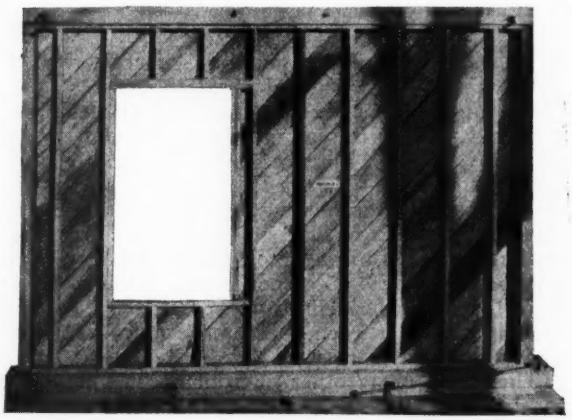
1. Frequency of nailing.
2. Size of nails.
3. Inclination of sheathing.
4. Types of bracing.
5. End matching.
6. Seasoning of lumber.
7. Effect of window and door openings.
8. Effect of lath and plaster.
9. Effect of vibration.

Size and Number of Nails Important

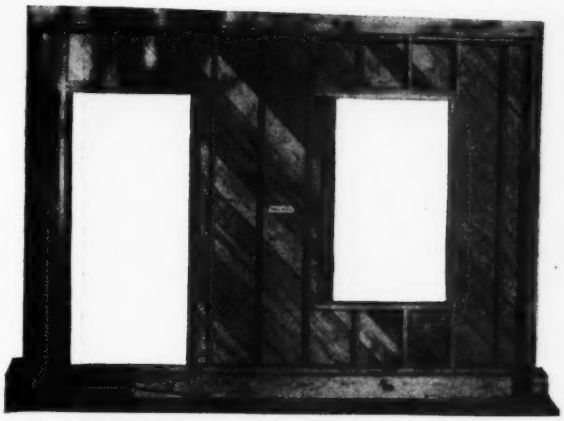
Three nails per stud in horizontal sheathing boards do not increase the wall stiffness appreciably, since the middle nail of the three is about at the center of the resistance couple set up by the outside nails, or, in other words, acts just as though it was the only nail in the board. Four nails per stud in 1-in. by 8-in. horizontal sheathing increase the strength and stiffness about 40 per cent. Naturally, the resistance of the inner pair of nails to twisting is less than that of the outside pair. The effect of more nails on diagonal sheathing is much more important. Here the sheathing boards act with the framing as tension or compression members of a small truss, and each additional nail holding them in place adds considerably to the strength of the whole. Three nails instead of two increased the stiffness from an average of 3.8 to 5.2, and four nails brought it up to 7.5. Increases in strength were not measured in these cases, but the strength was well beyond any likely to be required of frame construction.

When, due to end thrust, a horizontally sheathed panel gives away, it is usually the nails which fail first. They bend and twist before the wood splits and, therefore, heavier nails, as is to be expected, make a stiffer and stronger panel. Two 10d instead of 8d nails increased the stiffness of a horizontally sheathed panel 50 per cent and the strength 40 per cent. When 12d nails were used, strength and stiffness fell off again, perhaps because the large shanks split the boards more seriously. Larger nails make little improvement in the strength of diagonally sheathed panels, because the boards are not twisted about the studs when the panels resist pressure, and the greater strength of the nails is not brought into play.

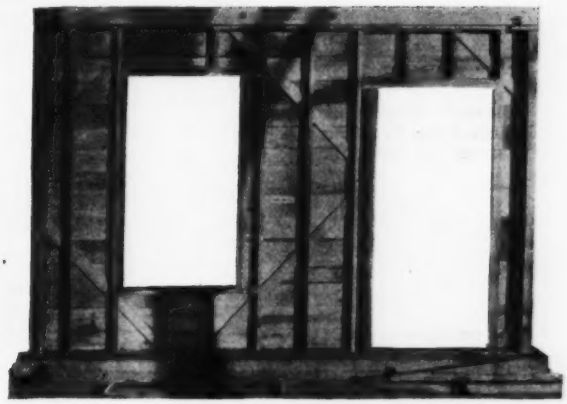
With two 8d nails to each stud, a diagonally sheathed panel is about 8 times as strong, and from 4 to 7 times as stiff as a similar horizontally sheathed



A Window Opening Framed in a Diagonally Sheathed Panel Reduced Its Stiffness 28 Per Cent and Its Strength About 40 Per Cent.



A Door and Window in a 9-ft. by 14-ft. Diagonally Sheathed Panel Reduced the Stiffness 63 Per Cent and the Strength 30 Per Cent.



Diagonal, Let-in Braces in a Horizontally Sheathed Panel More Than Make Up for the Weakening Effect of a Door and Window.

panel. When it is realized that this tremendous increase is secured in the average railway building with very little sacrifice of time and material, it is hard to believe that horizontal sheathing will continue to be used in any amount.

Green Lumber Unsatisfactory

Several types of bracing are in common use to stiffen frame walls, and three of these methods were tested. Herringbone bracing, or "fire-stopping" as it is often incorrectly called, increased the stiffness of a horizontally sheathed panel only 30 per cent and the strength only 10 per cent, while 2-in. by 4-in. braces cut in between the studs, brought increases of 60 per cent and 40 per cent respectively. The important discovery made in this field was that 1-in. by 4-in. strips, let into the faces of the studs beneath horizontal sheathing, increase the stiffness from 2½ to 4 times, and the strength about 3½ times. For buildings where sheathing is omitted and the siding is applied horizontally, the let-in bracing strips offer the best assurance of stiffness and strength.

Relatively few railways have yet had experience with the side and end-matched roofing and sheathing boards that are just becoming available commercially. The advantages of these boards are that the ends do not have to be butted over the studs and no sawing is necessary except at openings or corners, and, therefore, waste is almost eliminated. Tests were made to find out if walls thus sheathed are as strong and rigid as when the boards are butted over the studs, and it was found that side and end-matched boards, 1-in. by 6-in., gave as good resu'ts as 1-in. by 8-in. butt-edged boards.

In some parts of the country buildings are often constructed of green or partly dried lumber and results are seldom satisfactory. To discover what happens when such lumber dries out, two panels were sheathed horizontally and two diagonally with green lumber. After a month, during which the panels were dried under cover, tests showed the horizontally sheathed panels lost in drying about 40 per cent of the normal stiffness and 30 per cent of the strength of dry-sheathed panels. The diagonally sheathed panels decreased in relative stiffness from about 4 to 1.7. Strength tests were not made after seasoning. The test described represents, of course, the most extreme conditions likely to occur as a result of using green lumber, and it would appear that several other factors may have as much or more influence on stiffness and strength than the use of green lumber. In this connection note the results of vibration tests described later.

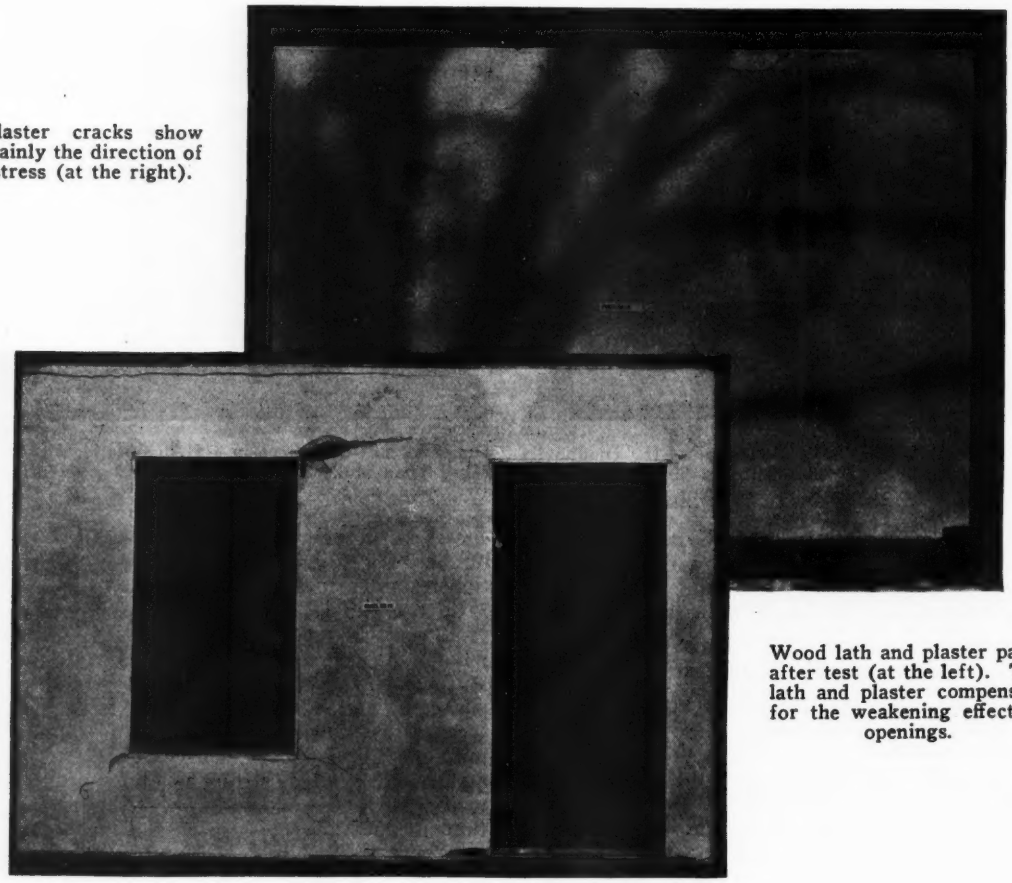
It was found that openings reduce the resistance of a wall to longitudinal thrust. A double 28-in. window in a diagonally sheathed wall reduced its stiffness about 20 per cent and its strength about 40 per cent, and adding a 3-ft. by 7-ft. doorway decreased the stiffness 65 per cent and the strength 50 per cent, although the wall was still twice as rigid and several times as strong as a horizontally sheathed wall with the same openings. Certain critical positions of openings may cause even greater reductions, but these are not likely to occur under practical conditions. Framing a door and a window into a horizontally sheathed panel decreased its strength and stiffness 20 per cent and 30 per cent respectively.

Wood lath and plaster, according to the tests, contributes surprisingly to the strength and stiffness of a building. Installed on a panel without sheathing, it afforded seven times the stiffness and four times the strength to be expected from horizontal sheathing. It increased the stiffness of a horizontally sheathed panel with window and door openings over 200 per cent. Wood lath and plaster with horizontal sheathing and let-in braces around openings made a panel slightly stiffer than one with diagonal sheathing and the same openings, and nearly as strong. The influence of wall and partition openings in causing plaster cracks is thoroughly apparent from the results of tests on plastered panels. The top plates of those without openings moved about 3/8 in. and a thrust of 8,000 to 12,000 lb. was necessary before plaster cracks developed. A thrust of 800 lb. to 1500 lb. and only a few hundredths of an inch movement caused cracks in those with openings.

The question naturally occurs as to whether the extra stiffness and strength of walls secured by bracing, diagonal sheathing or other expedients will survive the loosening effects of the many storms occurring throughout the life of the building. To discover what these effects might be, several panels were set in a vertical position on the table of a large box-testing machine. This machine is designed to jerk a box of merchandise sharply back and forth, imitating the racking and swaying effect of railroad or track transportation.

In this instance, the "throw" of the machine table was such as to jerk the panel out of plumb at each vibration about two-thirds as far as it would go un-

Plaster cracks show plainly the direction of stress (at the right).



Wood lath and plaster panel after test (at the left). The lath and plaster compensate for the weakening effect of openings.

der the regular pressure test without permanent damage. Four panels, two horizontally sheathed and two diagonally sheathed, were thus subjected to 50,000 cycles of vibration. One panel, horizontally sheathed with green lumber and allowed to dry out one month, was given one million cycles of vibration. The ordeal of 50,000 cycles, or 100,000 severe jerks, did not decrease the stiffness and strength of the dry-sheathed panels perceptibly. The loss of 30 per cent in stiffness and strength of the green-sheathed panel after 2,000,000 jerks was only what might be exected.

Increased Life of Structure

Considering the large amount of money spent by the railways for frame buildings each year, a few simple precautions, such as the use of diagonal sheathing or effective let-in bracing, the use of heavier nails on horizontally sheathed structures or of more nails on those diagonally sheathed, the employment of wood lath and plaster with its tremendous stiffening influence on the structure, and the use of reasonably dry lumber will increase the strength and stiffness of these buildings many times over that now generally realized, and will correspondingly extend their consequent prospect of structural durability. Commenting on the tests the Forest Products Laboratory's report states:

"Plaster on wood lath may furnish all the rigidity necessary for most purposes under normal conditions. However, as the plaster begins to crack from shrinkage, settlement or other causes, the rigidity of the sheathing comes more and more into play. Thus in violent winds or earthquakes it is the sheathing that becomes all important in preventing complete destruction. It is logical, too, that slightly more resistance than is necessary to resist ordinary distorting influences will in the long run more than pay for itself through diminishing, if not entirely eliminating needless annoyances and frequent maintenance costs that result from the structure getting out of alinement. Diagonal or well-braced horizontal sheathing affords far more rigidity than horizontal sheathing without bracing. Either diagonal or horizontal sheathing is important from the standpoint of insulation and also assists in distributing loads.

"The old 'braced-timber' frame, which originated in New England, perhaps had far more rigidity than was needed, but the hundreds of old buldings still standing bear witness to the fact that rigidity went hand in hand with permanence. Today we cannot afford to use in moderate priced buildings the heavy type of construction employed then. The modern adaptation of the braced frame with its small built-up corner posts and light corner bracing, or the present-day balloon frame with the studs carrying through for two stories, represent a great economy of material over the old style of braced frame.

"Through a modern tendency to cut costs, bracing is often omitted and horizontal sheathing is used because it is cheaper to put on. Although the inexpensive building is not necessarily an unsound building, nevertheless certain fundamental principles should be kept in mind so that when construction methods are employed to reduce costs the methods will be such that will result in no harm to the structure. Further, the added cost of adequate bracing is so small that it can hardly be felt in the total cost of the building."

Fighting Snow in a Real Snow Country

An account of problems encountered and methods employed in keeping the Canadian National Lines open during the winter*

By C. B. BROWN
Chief Engineer, Operating Department,
Canadian National

A Rotary Plow at Work

THE AVERAGE annual snowfall along the railways in Canada, from observations extending over a period of 30 years, ranges from 25 in. on the Pacific coast to 130 in. in the interior and 100 in. on the Atlantic coast. The heaviest annual average recorded snowfalls vary from 117 in. at Quebec to 130 in. at Parry Sound, Ont., while the heaviest individual falls vary from 12 to 18 in. and usually occur during the early and late months of the winter.

The greatest hindrance to the operation of trains is occasioned by low temperature and fine snow drifting across the open spaces into cuts, where it is packed hard over the tracks. Where there are forests bordering the railway's lines, the average snowfall does not cause much inconvenience. Long continued snow storms with high winds are difficult to handle and sometimes cause a complete blockade.

Winters in Canada vary considerably. Some are remarkable for the frequent and long-continued snow storms, while others are equally remarkable for the absence of heavy snowfalls or high winds. As there is no means of determining in advance with any certainty just what to expect, the railways must always be prepared for the worst.

Advance Preparation Is Made

In advance of the winter months the snow-fighting equipment is completely overhauled and put in good condition for service. This equipment usually consists of the following: Rotary plows, wedge plows, wing plows, snow flangers, ice cutters, spreaders, locomotive hoisting cranes and snow loaders. There are also combinations of wedge and wing plows and flangers, all three in one unit.

Each plow is equipped with communication cords, signal lanterns, snow shovels and spare parts. In addition, the maintenance forces are provided with snow shovels, ice picks, switch-cleaning brooms with chisel points, and ice thawing devices for switches and interlocking plants.

In advance of the usual winter season, the snow-fighting equipment is distributed over the divisions and districts, having regard to where the heavier fall of snow may be expected. The selection of the points for assembling this equipment is governed principally by the difficulties that have been experienced in the past in keeping the lines open during the winter months. Generally, terminal stations, where power is available, are favored; also junctions where several lines are concentrated; and ends of branch lines, from which passenger train runs are started.

A complete list of carefully selected operators and men for manning the snow-fighting equipment is then recorded at each assembling or train despatching point, so that they may be readily and quickly available in case of need. The entire snow-fighting equipment and forces are under the control and direction of the various division superintendents and their staffs.

The National Meteorological Weather Bureau sends out weather reports at least once every 24 hours, and more frequently when severe storms that may affect the operation of the railways are anticipated. These reports are available all through the territory occupied by the railways. In addition, each operating officer receives daily reports from the stations along the lines of the railway under his direct control, and from adjoining districts, of prevailing weather which may affect his own. Trackmen also report as to snow conditions, length and depth of drifts on their individual sections and subdivisions. When storms are prevailing, reports are also made by the trainmen out on the road, indicating the conditions along the route and where snow is accumulating that may cause trouble. From these various reports, both general and local, the operating officer is kept informed and can foretell when it is necessary

*Presented before the World Engineering Congress, at Tokyo, Japan, October 29, to November 7, 1929.

to start the snow-fighting equipment and the kind of equipment and forces required.

Heavy Equipment Is Used

During the early months of the winter, before there is an accumulation of snow filling the open spaces adjoining the tracks, it is not very difficult to keep trains moving, particularly on lines where the train movement is frequent and continuous. As each successive storm adds its quota to the previous accumulation, and there are no trains moving for several hours, the difficulties increase very rapidly, especially

A Snowbound Train

on light-traffic branch lines where there are only one or two trains operated, and then only in the daylight hours. Snow-fighting trains are regulated by the operating rules, which provide for speed restrictions where necessary to safeguard stations and other trains.

The severity of the storm and the snow conditions along the lines govern the starting of trains and the manner of fighting the storms and keeping the lines open. On important through routes, during severe snow storms accompanied by high winds, freight trains are tied up at terminals and efforts are concentrated in keeping the passenger trains moving.

A Snow-Plow Extra Precedes Passenger Trains

Before a passenger train is due to leave, a snow-plow extra is ordered and precedes it over the line. The snow-plow extra consists of a wedge or combination wing and flanger plow, one or two of the heaviest locomotives (depending upon the depth of snow), and the conductor's van. Before starting the plow extra, the official in charge is advised of storms and snow conditions over the subdivision, and the location of trains moving or tied up in passing tracks. The plow train usually precedes the passenger train by one hour, or in cases of bad drifts, from station to station in advance, and runs through to the next terminal or to an intermediate "wye," where it can be turned. If the storm is severe, the plow is run between the terminals as long as the drifting continues. The effect of the wedge plow is to keep the rails free from heavy drifts, and side clearances established, so that freight traffic can be resumed as soon as the storm lightens or ceases.

As soon after the storm as possible, and when the movement of trains is again normal, the "mopping up" of the freshly fallen and drifted snow is started, and consists of clearing wheel flangeways, widening side clearances in cuts and drifts, and removing snow from passing tracks and sidings in preparation for the next storm. The equipment used for the cleaning up consists preferably of a combination wedge plow, wing plow and flanger, a locomotive, a coach for snow shovelers, a spreader and a caboose. The snow shovelers are only added to the force if there has been heavy drifting and if there are cars on sidings buried in the snow, which have to be shovelled out.

The speed at which snow-plow trains are operated depends upon the amount of snow over the rails. Sufficient weight and momentum are required to get through the drifts without stalling, and at the same time, to throw the snow far enough so that it will not fall back into cuts. When the depth of snow exceeds 6 ft. over the rails, a maximum speed of 45 m. p. h. may be necessary. Drifts covering one side of the track to a greater depth than the other are dangerous and liable to cause derailment of the plow. However, an experienced operator will avoid this. If the snow over the tracks is too deep or too extended to be removed by the ordinary plow, a rotary plow is brought into use to clear the tracks.

Snowbound Trains Are Not Uncommon

The regular track forces are considerably reduced in winter months when all track work ceases, so that it is frequently necessary to employ extra men temporarily as snow shovelers. During storms the trackmen are engaged in cleaning out switches, crossings and interlocking appliances so that they are in a workable condition. They also shovel the snow from station platforms and sidings and keep the approaches to level highway crossings passable. The section foremen also send in daily reports of the snow conditions on their sections, and more frequent reports, when necessary, during severe storms.

Flanger and wing plow markers or guides are set up in advance of obstacles which will interfere with

Many Shovelers Are Employed

the full use of flanger knives or the wings or drop nose of the snow plow. These markers are placed as conspicuously as possible and protect planked highway crossings, switches, through and half-through bridges, stations and other structures which would interfere with the complete operation of the snow-fighting equipment.

The foregoing illustrates the method of fighting the ordinary snow storms of winter. There are, however, other and more extreme conditions to be overcome for which the railway must be prepared, and which are common to railway operation. Passenger and freight trains become stalled in snow drifts; branch lines become completely blocked with snow; there are snow slides in the mountain sections; and many situations arise, which demand the utmost vigor and resourcefulness of the railway officers to overcome. To combat these extreme conditions the ordinary appliances are insufficient or unworkable, and extraordinary equipment, such as rotary plows, spreaders and mechanical ice cutters are employed in addition to the regular snow-fighting appliances. Also, complete outfits for lodging and boarding large gangs of snow shovelers are frequently added as a very necessary adjunct to the "mopping up" train when trains are stalled or lines are blocked with drifted snow.

Snow Fences and Sheds Help

As drifting snow is the most prolific cause of the difficulty in train operation, both permanent and temporary snow fences are erected to catch the snow before it reaches the tracks. The permanent fences, consisting of wooden slats or spruce-tree hedges, are placed on the right-of-way line, and temporary fences are placed about 50 ft. back on the adjoining property, for which permission is obtained from the proprietor. The locations and extent of the snow fences are governed by the previous experience gained concerning the accumulation of snow on the tracks, and are usually placed to protect cuts which become filled frequently with drifted snow. It is sometimes necessary to use three lines of fencing in winters of heavy snowfalls and high winds. Railway lines in the mountains, where snow slides are frequent, are protected by snow sheds, over which the slides may pass without blocking the tracks, but this method of protection is being gradually abandoned, as replacements are very costly.

Heavy Work Encountered at Terminals

The operation of passenger stations and large freight terminals during a winter of heavy snowfall is a matter of considerable trouble and expense. The handling of trains and cars is not only retarded, but sometimes only partially carried on with the greatest difficulty. Twelve inches of freshly fallen snow on top of previous accumulations causes a serious delay in regular movements and may result in the holding out of trains from the terminal until a clearance has been made.

Snow-fighting equipment is of little use in a terminal and the most effective organization is an army of snow shovelers. Not only are the temporary idle employees of the railway used, but the unemployed laborers of the adjoining towns and cities are pressed into service, sometimes as many as 1,000 snow shovelers being required in one terminal.

The uncovered passenger platforms have passageways cleared to the trains by piling the snow in heaps on the platforms. As soon as a lull in the passenger service occurs, work trains consisting of low-side, flat-bottom coal cars or flatcars are backed into the station and loaded with snow. The trains are then pulled out of the terminal to a high embankment or bridge and unloaded, and the snow is then pushed back with spreaders. This is repeated until the passenger tracks have been cleared.

In freight terminals the main leads and switches are first cleared by snow shovelers who pile the snow between the tracks. As soon as a working space is provided, the piles of snow are loaded on to snow trains and disposed of in the manner previously described. In the main yards, which are usually filled with cars, it is necessary first to pull the cars from two tracks to provide a working space so that the snow can be pushed back with a wing plow or spreader, the accumulation over several tracks being piled up so that it can be loaded on to flat cars by the snow shovelers or by mechanical means. This process is necessarily slow, but gradually the tracks

A Snow Cut

are cleared and space is provided for the next fall. The spreader is the most useful appliance in clearing large yards of snow.

Expense Necessarily Runs High

The cost of the removal of snow varies with the quantity and frequency of the snow fall. The vagaries of winter cannot be foreseen. Neither sudden variations in temperature, high winds nor duration of storms can be anticipated, all of which may affect the cost. The cost of snow removal varies from $50 to $100 per single-track mile per year for all tracks. some regions will expend $300 per mile per year, but the general average over a period of several years will not exceed $75 per mile.

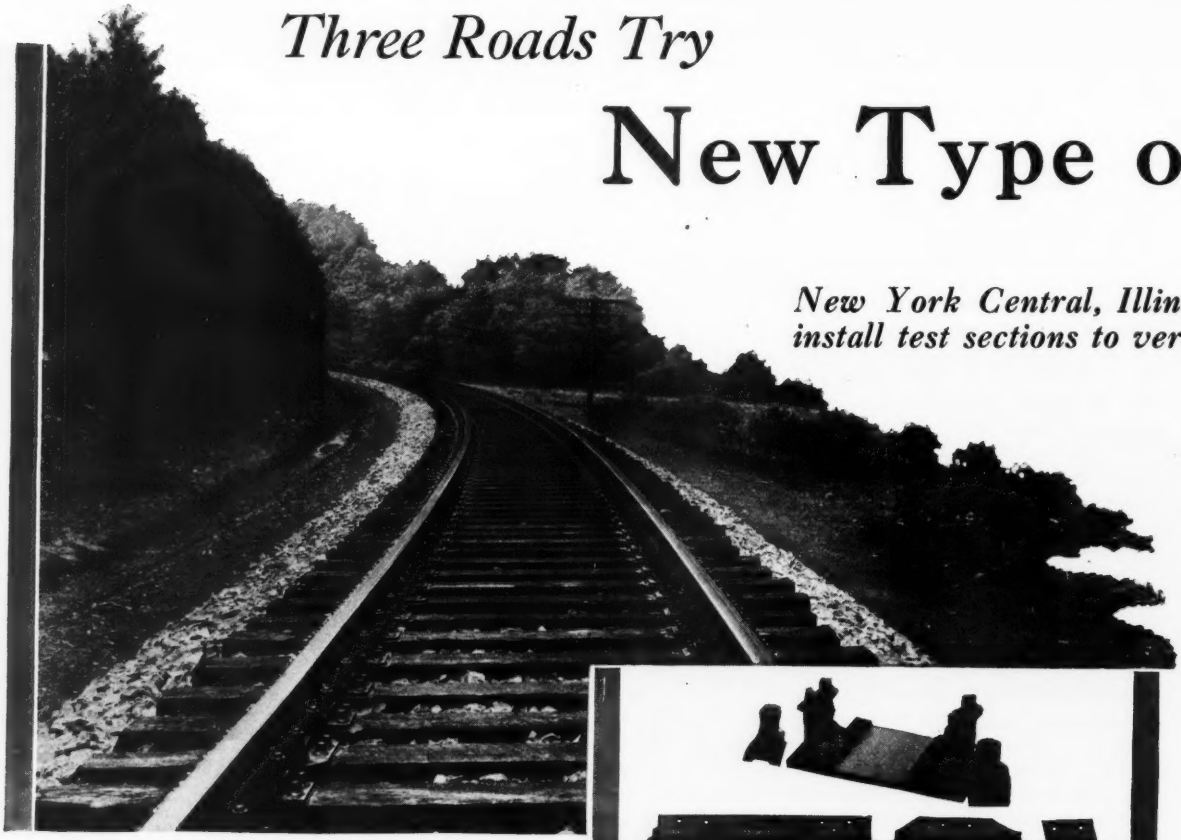
The following principal rules govern the successful handling of snow on the Canadian National:

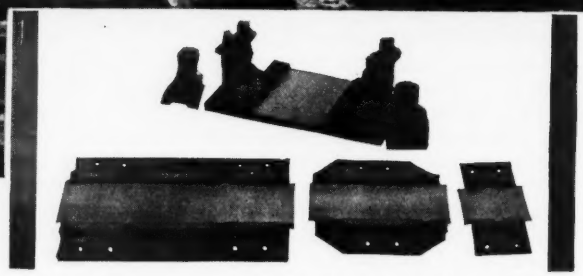
1. Overhaul the snow-fighting machinery every year and see that it is in the best possible condition and fully equipped for immediate service.
2. Assemble the equipment at convenient stations where it is most needed, and store it on tracks easy of access.
3. Select the most experienced men to direct the operations and see that they are familiar with their districts in winter garb, and also, with the location of physical obstacles to the full use of equipment.
4. Perfect arrangements for prompt and thorough weather reports indicating the direction and paths of storms and local snow conditions.
5. See that the maintenance forces are fully equipped with snow-fighting tools and that the sources of supply of large forces of labor are known and recorded.
6. See that all deep cuts and exposed tracks where snow can drift are protected by permanent or temporary snow fences. "Prevention is much better than cure."

Three Roads Try

New Type of

New York Central, Illinois install test sections to verify





A Complete Intermediate Tie Plate Assembly and Three Styles of Geo Plates

At the Left—Geo Track on a 4-deg. 30-min. Curve on the New York Central. At the Right—Similar Construction on a 5-deg. 45-min. Curve on the Missouri Pacific

THREE of the larger railways of the United States, the New York Central, the Illinois Central and the Missouri Pacific, have recently installed test sections of a type of track that is new in this country, but which is being used extensively in several European countries, especially in Germany. The fundamental differences between this new type of track, which is known as "Geo" track, and common track construction, lie primarily in the design of the tie plates for both joint and intermediate ties, the method of fastening the plates to the ties, and the method of holding the rails in position. Other differences lie in the design of the joint splice bars and the use of compressed wooden shims as cushions between the rails and the tie plates.

Three miles of this track are now in service in this country: One mile in the northbound main track of the Illinois Central, near Carbondale, Ill.; another mile in the single-track Kansas City-Osawatomie line of the Missouri Pacific, about 10 miles south of Kansas City, Mo.; one-half mile in the eastbound freight main of the New York Central, about four miles east of Rome, N. Y.; and another half mile on the Pennsylvania division of the New York Central, near Jersey Shore, Pa. All of these sections were installed during the latter part of November and the early part of December, 1928, with the exception of the section near Jersey Shore, which was not installed until last spring.

General Features of the New Track

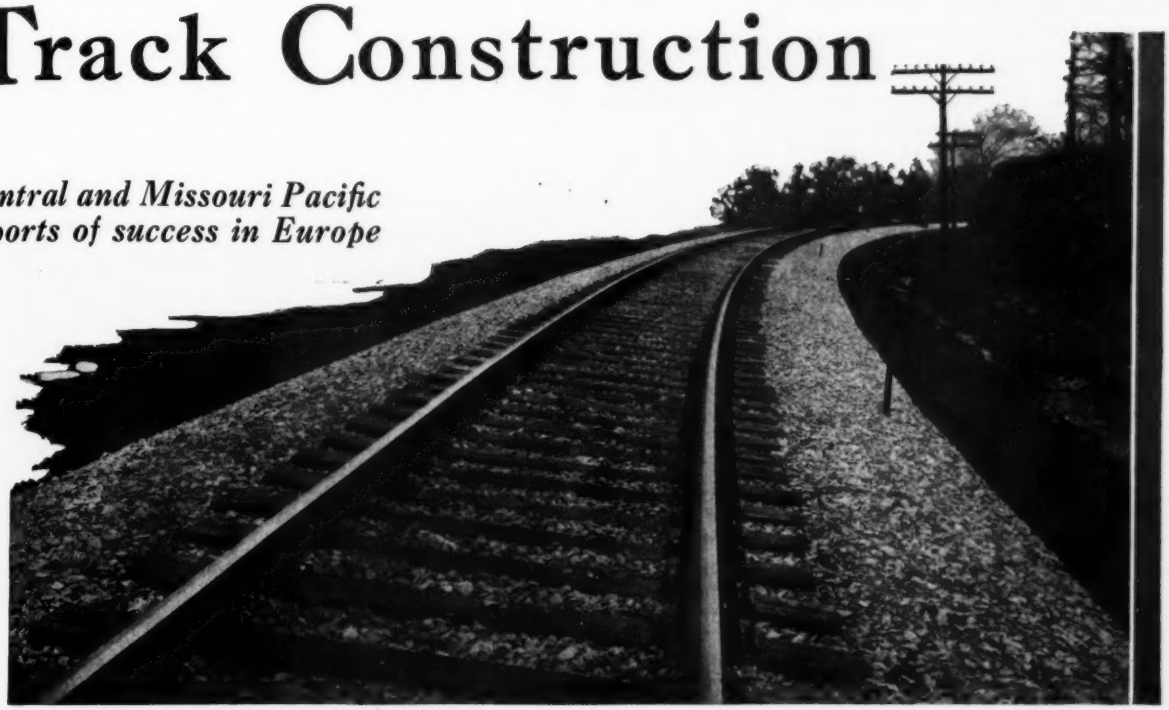
In this type of track construction, the intermediate tie plate assembly consists of a special rolled steel tie plate, two rolled steel clamps with bolts for holding the rail to the plate, a wooden shim and four screw spikes for holding the plate rigidly to the tie, independent of the rail fastening. All of the metal parts of this assembly are manufactured from steel containing 0.25 per cent copper.

The tie plates vary in size with the section of rail used, but, in general, are larger than those used in this country. These plates have a smooth base, but their top face is provided with two rail shoulders, each about one inch square in section, which hold the rail in alinement. The plates are canted as desired and have four round spike holes.

The rail is secured to each plate by two rolled steel clamps, each three inches long and more or less similar in cross-section to a flattened letter "U." These clamps, one of which is used on each side of the rail, are placed with their legs downward, straddling the shoulders on the plates, the inside leg of each clamp bearing on the flange of the rail base, while the outside leg bears on the tie plate just outside the shoulder. The clamps are drawn down firmly against the rails and the plates by means of a bolt and nut assembly, in which the bolt, which is ⅞ in. in diameter and 2¾ in. long, has a special head, semi-circular on the under side, which fits into a slot of similar section milled into the center of each of the shoulders on the plates. The threaded shank of the bolt passes up through a hole in the top of the clamp and is gripped by a hexagonal nut fitted with a double spring washer. Thus, at each plate, the rail is gripped firmly on each side through

Track Construction

Central and Missouri Pacific reports of success in Europe



a distance of three inches by a fastening which is entirely independent of the tie fastening.

The tie plates are fastened to the ties by means of four screw spikes which are inserted into pre-bored holes. These spikes are similar to the A. R. E. A. screw track spike, except that the underside of the head is flat instead of sloped.

Use Creosoted Poplar Shims

The shims, which are applied between the tie plates and the rail base, are made from poplar, which, after being cut to size, is compressed from a thickness of 23/64 in. to 13/64 in. and then creosoted. These shims have the same width as the rail base but are of such length that they overlap the sides of the tie plates about one-half inch on each side. Through this arrangement, the ends of the shims, which are not under the pressure of the rail, swell to their original thickness under the influence of moisture and the air, forming rims which prevent the movement of the shims parallel with the rail under traffic. Lateral movement of the shims is prevented by the rail shoulders on the tie plates.

The joint plates of the Geo track are of the same design as the intermediate plates, except that they are wider and have two or more rail clamps on each side. These plates are made for both the supported and suspended types of joints, and in both cases the shoulders are continuous throughout their widths. The splice bars used in connection with the plates are more or less similar in section to the head contact joint bars in use in this country, except that the lower leg of each bar has been cut back to fit within the plate shoulders. These bars can be furnished with either four or six holes as desired, and either type of bar can be used with either of the two types of joint plates.

It is recommended that in making an installation of Geo track, a method be followed which has proved successful in certain European countries. In this method, which, in effect, is to provide an entirely new track structure above the base of the ties, the section of track to be rebuilt is turned over to the track forces and is completely dismantled in advance of the new track construction. In other words, this method calls for the renewal of the rails and all track ties, and either the cleaning of the old ballast with the addition of such new ballast as may be necessary, or the complete stripping of the old ballast down to the bearing surface of the ties, and the addition of new ballast. This work, as it is carried forward, is followed by the new track construction, which calls for pre-adzed and bored treated ties, new rail and Geo tie plates and rail fastenings.

Use of Power Tools Recommended

In carrying out the installation of this type of track on a large scale, certain other practices have been found economical, and advisable not only from that standpoint, but also from the standpoint of securing better track and speeding up the construction in the field. These include the screw spiking of all tie plates to the ties at the treating plant, using power-driven equipment, and also the use of power wrenches in the field for tightening all rail clamp bolts.

While the practices recommended are recognized as the most economical, evidence that the new track can be installed under far less favorable conditions is seen in the work of all three of the roads which have constructed test sections of Geo track in this country. In none of these cases were the recommended practices followed in every detail, owing to the inadvisability or inconvenience of organizing so completely for the construction of only a mile or less of track, although each of the three roads tried to

comply with the recommendations in-so-far as it was possible for them to do so under the conditions involved. Depending upon these conditions, the methods used by the three roads in installing their test sections differed somewhat in detail, but in general they were the same, and, therefore, attempt is made here to describe briefly only the method used by the New York Central in constructing its half-mile test section near Rome, noting only the more important variations in this method adopted by the other two roads.

How the Work Was Done on the N. Y. C.

In constructing the test section near Rome, which is located in the heavy-traffic eastbound freight main, every effort was made to surround the test with conditions favorable to the new type of track, and yet to adhere to New York Central standards and methods as closely as possible. Thus, as recommended, the rails and ties were renewed completely and the ballast was cribbed out and cleaned before being replaced in the new track. Likewise, Geo tie plates and track fastenings were used throughout. The new rail was the standard 105-lb. Dudley section of the New York Central and the ties were all of creosoted oak, maple, birch and beech, 7 in. by 9 in. by 8½ ft., similar to those used elsewhere in this class of track on the New York Central. Sixty per cent of the joints in the test are of the supported type with six-hole bars, while the remaining 40 per cent are of the suspended type with four-hole bars. This was done to test the relative merits of each type of joint using Geo construction. Likewise, the New York Central standard of 24 ties to the 39-ft. panel was used for the most part, although 10 panels of only 22 ties each were provided, as recommended with the new type of construction.

All of the new plates used in the installation have a cant of 1 in 40, which is standard on the New York Central, and are 53/64 in. thick at the heel and 19/32 in. thick at the toe. The intermediate plates are 14 5/32 in. long by 6¾ in. wide and weigh 21½ lb. each; the supported type joint plates, which are 14 5/32 in. long, from heel to toe, and 16 11/32 in. wide, weigh 50 lb. each; and the suspended type joint plates, like the other plates, are 14 5/32 in. long, but are 27¼ in. wide and weigh 90 lb. each. All of these plates have the same cross-section from heel to toe, and are truly rectangular in plan, except the supported type joint plates which have had their corners cut off to save metal and to reduce their weight.

The conditions under which the New York Central installed the Geo track near Rome were possibly less favorable than those which existed in connection with the installation of any of the other test sections. This was due in the main to the fact that the weather in the vicinity of Rome was very severe in December, 1928, and to the further fact that the traffic at this point is extremely heavy. The first operation was the renewal of the rail over the test section, and this was done entirely independent of the other work, and a week or two in advance. Prior also to the actual work of installing the new track, the new ties, which were adzed and bored and then treated at the New York Central's treating plant at Rome, were delivered to the site and distributed along the outside shoulder of the track, in such position that they could readily be pulled into position as the old ties were removed. Likewise, all of the new tie plates and track fastenings were delivered to the site and made ready for distribution as the work progressed.

A Section of the Geo Track in the Eastbound Freight Main of the New York Central Near Rome, N. Y.

In carrying out the work, an advance gang was employed in screwing the tie plates in position on the new ties as they lay along the right-of-way. This work was done at first with hand wrenches, but later much more effectively by means of an Ingersoll-Rand pneumatic screw spike driver.

While this work was going on, another gang

cribbed out the ballast from between the ties of the old track, and was followed by others which pulled the old cut spikes, jacked up the track, and replaced the old ties with the new ties already provided with Geo plates. In carrying out this latter work, care was taken to keep the track passable at all times, and with this in view, alternate ties were first renewed over a section of each panel, followed by the renewal of the remaining ties. As the ties were put

Applying Geo Plates to the Ties With a Pneumatic Screw Spike Driver on the New York Central

in place, the poplar shims were inserted between the plates and the rail base, a dab of a lubricating mixture of tar, asphalt and lime was put in each of the clamp bolt slots in the ribs of the plates, and each tie was then pinched up while the rail clamps were inserted and the clamp nuts turned down sufficiently to hold them in place. After most of the ties for the day's work had been inserted, men followed up perfecting the surface and alinement, after which all clamp bolts were thoroughly tightened, this being done by hand with a socket wrench, for lack of a power-driven tool. At the same time, the ballast was cleaned and forked back into the tie cribs.

The Other N. Y. C. Test Section

The other half-mile test section on the New York Central, completed early in June of last year, is on the single track line of the road between Jersey Shore, Pa., and Lyons, N. Y., about eight miles north of Jersey Shore. Here, the entire test section is on a grade of approximately 0.3 per cent, one-half on tangent track and the other half on a curve of 4 deg. 30 min.

Throughout the length of this test, the track was given a raise of three to four inches, carrying the raise along as all new treated ties were inserted, in the same manner as when any new rail is surfaced. This method differed from that used at Rome owing to the fact that the grade near Rome could not be raised on account of a steel bridge within the installation. Also, the ties for the Jersey Shore test were delivered to the site of the work with the tie plates already attached to the ties, with the exception of the suspended joint plates. New rail of 105-lb. Dudley section was laid and in 12 panels, only 22 ties were used to the panel, as recommended with Geo construction, while in the remaining 55 panels, 24 ties were laid to the panel. Sixty per cent of the joints in the test are of the supported type with six-hole bars, while the remaining 40 per cent of the joints are of the suspended type with four-hole bars.

On the Illinois Central and Missouri Pacific

In the one mile test section on the Illinois Central, which involved heavy grades in both directions, new 110-lb. R. E. section rail was used on new 7-in. by 9-in. by 8½-ft. creosoted red oak ties, and all of the new plates installed were the same as those used on the New York Central, except that practically all of the joints installed were of the suspended type, using a four-hole bar. In carrying out the work on this section more nearly ideal conditions were afforded than on the New York Central near Rome. In the first place the weather was more favorable and the work was done without interference from traffic. The new ties were unloaded along the right-of-way ready for use, the tie plates having been applied previously at a central point, using a pneumatic screw spike driver. In other respects the work on the Illinois Central was, in general, done in the same manner as at Rome.

In making the test installation on the Missouri Pacific a number of special features were adopted. On this road, where the test section is practically all on curves and with grades in both directions, the work was done under traffic and the track was relaid with new 90-lb. A. R. A.-A section rail on new 7-in. by 9-in. by 8-ft. treated ties of pine and red and white oak. The Geo intermediate plates on this section were similar in design to those used on the other two roads, but slightly smaller. All of the joint plates installed were for the suspended type of joint with four-hole splice bars, but these plates

Placing One of the Poplar Shims Between the Rail Base and a Tie Plate

were furnished in two different sizes, half of the plates being of each size These plates have relatively the same lateral cross-section as the similar plates used on the other roads, but in one set, they are 27 in. wide and weigh 80 lb. each, while in the other, they are 32 in. wide and weigh 102 lb. The distinctive feature of the 32-in. plates is that they have four rail clamps on each side. These plates were arranged for in order to study the effects of

their larger bearing area and the greater amount of clamping action afforded at the joints.

In carrying out the work on the Missouri Pacific, the rail was renewed in advance, all of the new ties were furnished on the track with the tie plates screwed in place, and as much of the new track material as possible, was distributed in advance of the actual renewal work. As this work had to be done without interfering with traffic, the methods used were similar to those employed by the New York Central.

Many Principles Are Embodied

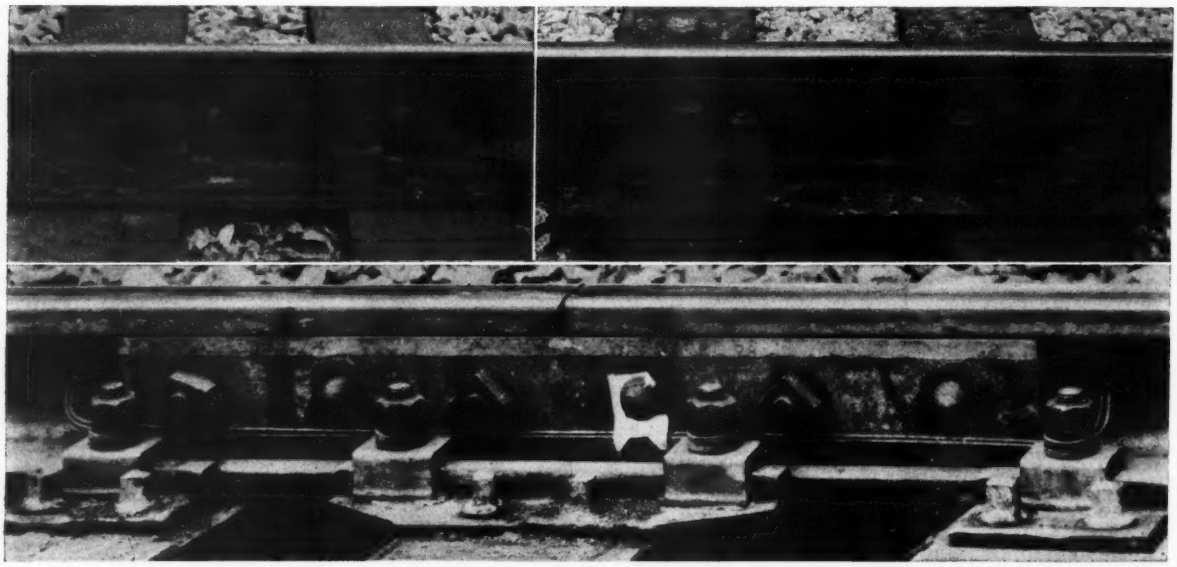
In the development of the Geo tie plate, each distinctive feature of its design has been worked out with the ultimate aim of providing a stronger, safer, and more economically maintained track structure. One of the principal objectives of the new type of construction is to prolong the life of ties by minimizing the mechanical wear and decay at the tie plate fastening. To this end the Geo plates have been made larger than the average plates used in this country, and the plate-holding spikes have been moved out as far as practical and made entirely independent of the rail fastening to reduce the strain on the wood fibres in the spike holes. The screw spikes used with the plates also have an important bearing in this regard as they call for the pre-boring of all ties, and have less destructive effect upon the wood fibre of the ties than cut spikes.

While these features in themselves are known to be effective in prolonging the life of ties, the principal feature to this end in the Geo type of construction is that the tie plates are so firmly seated on the ties that water is excluded and there is no movement whatever between the plates and the ties, and further, the rail is fastened tight to the plates and yet has a certain amount of elasticity. The elasticity is provided through the wooden shims and the double spring washers on the clamp bolts. The tight fastening of the rail to the plate by the clamp and clamp bolt is said to have the effect of increasing the width of the rail base.

It is also said that the shim and the secure fastening of the rail to the plate prevent hammer action between these parts; that there is less wave motion in the rail as it is stiffened by the clamps; and that Geo track holds its line much better than the usual construction. As these factors are of particular importance, it is expected that the life of ties will be largely increased, and that approximately 20 per cent additional life should be secured from the rail.

Through the tight grip of the rail clamps, which in effect makes the rail and the tie plates one unit, experience with this type of construction in foreign countries has shown that rail creeping is eliminated, although no rail anchors are used, and that expansion and contraction due to temperature changes are considerably reduced. As a consequence, it is said that the German State Railways, where Geo plates are standard construction, have standardized on 30-meter (98 ft.) rails on all of their main lines, making expansion allowances only about equal to that which is allowed by the railroads in the United States for 39-ft. rails. In view of this quality of Geo track, it was recommended that a minimum of expansion be provided in the test installations made in this country, but in an effort to check this feature, the rails were laid tight on the Missouri Pacific, the normal expansion allowance was reduced on the Illinois Central, and normal expansion was provided between the rails on the New York Central. Owing to the more rigid type of construction, it was suggested that sufficiently stable track could be secured by reducing the number of ties in each 39-ft. panel from 24 to 22, and this suggestion was incorporated in 20 panels of the work on the Illinois Central, 25 panels on the Missouri Pacific, and 22 panels on the New York Central.

Other advantages claimed for the new type of track structure are that it is smoother riding and much quieter, resulting in greater comfort to passengers and a saving in the maintenance of rolling stock; that with the plates applied at a central plant, using screw spikes, perfect gage will be secured and maintained; and that, owing to the greater holding



Above Left—The Suspended Type Joint Used Predominately in the Illinois Central Test. Above Right—The Same Type of Joint but With Four Additional Rail Clamps, as Used in the Missouri Pacific Test. Below—The Supported Type Joint With a Six-Hole Bar as Used in the Test Sections on the New York Central

power of the rail clamps, the stresses in the joint bars are greatly reduced. It is also claimed that the double shoulder plate prevents track buckling and rail spreading, and that there is considerably less danger of a serious accident in case of a broken rail. All of these claims lead to the broader claim that Geo track permits faster train operation with safety.

Reduced and more economical maintenance on this type of track is expected not only through the greater life of its component parts, but through the fact that the renewal of rail is simplified. In this operation, it is necessary only to release the rail clamps which hold the rails to the plates, and there is no necessity for disturbing the plates on the ties,

A Section of the Test Section on the Illinois Central

or for adzing or for plugging spike holes. In spite of the ease with which rails can be renewed, it will be noted that, owing to the high shoulders on the plates, the rails can be thrown out of gage only by raising them for a considerable length, which, in turn, requires the loosening of a large number of the clamp bolts.

Besides being standard construction on the German State Railways, where over 6,000 miles of Geo track is in service, this type of track is also employed on the railways of Belgium, Jugoslavia, Norway and Sweden, on which about 225 miles of Geo track is in service. In addition, Geo track is being tested in France, Spain, Japan and Hungary.

As might be expected, this new type of track construction has a higher initial cost than the present type of construction used in this country, but it is claimed by those who point to the results which have been effected in Europe, that this larger initial cost will be offset over a period of years by economies in maintenance.

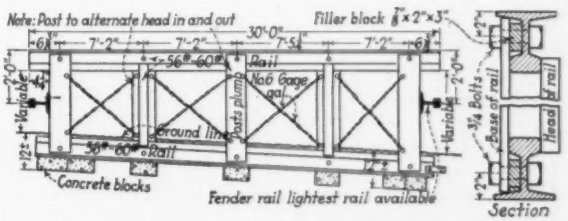
As definite arrangements had not been made for the manufacture of Geo tie plates and rail fastenings in this country, all of the special materials used in the installations on the New York Central, the Illinois Central and the Missouri Pacific, with the exception of the splice bar bolts and washers, were manufactured in Germany. It is expected that all of the materials necessary for further installations in this country will be furnished by American mills, operating under license from the American Geo Company, New York, which company arranged for the three test installations now in service.

A Unique Platform

THE Gulf, Mobile & Northern has developed a design for concrete cotton platforms which has as its unique feature the utilization of obsolete light-weight rail in the construction of the bents or trusses. This company estimates the cost of one of these structures with a three-inch pre-cast reinforced concrete deck to be approximately equal to that for a creosoted wood structure with the same thickness of deck.

As shown in the sketch, the trusses are constructed entirely of 56 lb. or 60 lb. rail, fastened with ¾-in. bolts and tied together with No. 6 twisted galvanized iron wire. The top and bottom chords of the trusses for this size of structure are continuous rails, the rail for the bottom chord being set in normal position while the rail for the top chord is inverted. The posts, of which there are five to the truss, consist of short sections of rail with a portion of the flange removed from each end in order to provide a firm bearing for the heads of the upper and lower chords. To attain maximum stability the heads of the rails which form the posts are placed alternately in and out. Since the ends of the posts are not flush with the flanges of the chords to which they are connected, it was necessary to insert a ⅞-in. filler block in order to obtain a proper connection. The lengths of these posts were computed from measurements taken on the ground, the information being turned over to an operator who cut the rails to the necessary lengths by means of an oxy-acetylene flame. To provide fenders for the front and rear of the platform, a light-weight continous rail was fastened to the outer posts of each bent two feet below the deck, which is level and 3 ft. 8 in. above the top of the track rail.

When constructing the slabs, in order to attain a perfectly smooth floor, particular attention was given to securing a uniform thickness along the five-foot



Details of the Truss Construction

sides. The concrete in the units was a 1:2:4 mix, which was overlaid by a ½-in. wearing surface of a 1:2 cement mortar, while the bottom surface is plastered to a depth of ¼ in. with a 1:2 mortar, placed against expanded metal which is firmly anchored into the slab. In addition to the expanded metal, the slabs are reinforced with ¼ in. round rods spaced 15 in. and parallel with the five-foot side, while ⅜-in. rods on 8 in. centers are placed parallel to the six-foot sides. To prevent the spalling of the upper edges, the slabs are protected on all four sides with 1¼-in. by 1¼-in. by $\frac{3}{16}$-in. steel angles, with one leg imbedded in the edge of the slab and the other leg in a vertical position flush with the edge.

This platform is designed to carry a load of 200 lb. per sq. ft. or a total of 90 tons. Its use is proving satisfactory in every way, and it is expected that this type of construction will be used at other points as occasion arises.

The Crosstie in Canada*

A resume of the practices of the Canadian National with particular reference to preparation and preservation

By G. P. MAC LAREN
General Tie and Timber Agent, Canadian National, Montreal, Que.

OF THE untreated ties, white oak ties are probably the most serviceable and such ties are still used to quite an extent in the United States. In Canada, however, very little white oak is available, and the cost of such ties is about 50 per cent greater than red oak and softwood.

Possible saving in money is undoubtedly one of the most important factors in determining the advisability of the use of treated ties, but another very important reason is forest conservation. In addition to the conservation of forest timber, the treatment of wood makes usable as ties such timber as beech, yellow birch and hard maple. A comparison of the service life of treated and untreated ties of different species used in Canada is as follows:

Class of Timber	Untreated	Treated
Jack pine	5 to 8 years	15 to 20 years
Hemlock	4 to 7 years	15 to 20 years
Tamarack	7 to 9 years	No tamarack treated
Cedar	10 to 15 years	Not treated
Red oak	5 to 6 years	10 to 25 years
Beech, yellow birch and hard maple	3 to 4 years	18 to 20 years

On the Canadian National all ties are purchased f.o.b. cars. The ties are made in accordance with the railway's specifications and are classified as follows:

No. 1 tie	9-in. face	7 in. thick	8 ft. long
No. 2 tie	8-in. face	6 in. thick	8 ft. long
No. 3 tie	6-in. face	6 in. thick	8 ft. long

The ties are inspected as loaded, by an inspector who is furnished with shipping instructions by the regional tie agent of the Canadian National. The inspector forwards to the regional tie agent a weekly report, showing in detail the number of ties loaded in each car, the car numbers, to whom shipped and the name of the manufacturer.

Today, about 60 per cent of our ties are sawed and about 40 per cent hewed. Less than 10 years ago the proportions were reversed. The author believes that in another 10 years there will be no such thing as a hewed tie. All hewed ties are barked or peeled and sawed ties have all bark removed from the wane by the producers before acceptance by the inspectors. Previous to 1925, the peeling of ties was done by the railway, but the advisability of having this work done by the tie contractors was evident, and after a strenuous three years of insistence on the part of the Canadian National, the desired result has been accomplished. The practice has resulted in a large saving to the railway and a fair profit to the manufacturers.

All ties are manufactured between September and January and shipments to the plants start in January and continue throughout the season until September 1. The plants where Canadian National ties are treated are located at Truro, N. S.; Newcastle, N. B.; Delson, Que.; Trenton, Ont.; Sudbury, Ont.; Sioux Lookout, Ont.; and Edmonton, Alta.

Seasoning of Ties

When received at the treating yard, the ties are piled in accordance with a standard approved plan, which calls for their stacking in such a manner as to allow the free circulation of air throughout each pile. In all cases the treating yards are kept free from vegetation and water; weeds are kept down by a liberal application of cinders, and water is taken care of by more or less elaborate drainage. These necessary precautions are taken to prevent attack from wood-destroying fungi. Before the ties are treated, they are properly air-seasoned. The time required for such seasoning varies for the different classes of timber and with climatic conditions, but is generally as follows:

Softwoods—from four to six months.
Hardwoods—from five to six months.
Red and white oak—one year.

The warmer and drier the air and the greater its circulation, the more rapid will be the loss of moisture from the timber. Coniferous woods can be given a much freer circulation than hardwoods, but too close piling will invariably bring about decay. During the seasoning period the ties are watched carefully, and where it is noticed that checking of the wood is taking place, "S" irons are applied.

The ties are adzed, bored and incised by machines which also stamp a "brand" on each end—the year and initials of the railway at one end and the rail section and a symbol for the class of timber at the other. These plants handle ties at the rate of seven per minute, or a capacity for a treating season of three quarters of a million ties, which is about the capacity for the treatment of ties at the average treating plant.

On the Canadian National all ties are treated by the Reuping process. Creosote, conforming to the specifications of the American Railway Engineering

*Abstracted from a paper read before the Montreal branch of The Engineering Institute of Canada, November 7, 1929.

Association for grade No. 1 oil, is used, together with coal-tar in the East, and petroleum oil at Edmonton and Sioux Lookout, the proportions being the same in both cases, i. e., 70 per cent creosote oil and 30 per cent coal-tar or petroleum in solution. This solution is heated to a working tank temperature of 150 deg. to 200 deg. F., and the pressures are held at from 180 to 200 lb. per sq. in. The total time required to treat a charge varies from three to five hours.

After the charge has been treated, the trams containing the ties are removed from the cylinders and the ties are stacked in the yard in close piling. Early the following year these treated ties are loaded in cars and distributed along the lines where they are required for renewals. The advantages gained by this method over the previous practice of shipping the ties at once are:

(1) Facility in handling; the cars do not become saturated with oil and the annoyance of fumes is avoided.
(2) The ties are distributed by train where required, saving the distribution on push cars by section forces which was formerly necessary.
(3) Saving in labor piling along right-of-way and covering with earth.
(4) By close piling back in the yard immediately after treating, the creosote has no chance to evaporate or leach out.
(5) A saving is effected over the old method of piling along the right-of-way.

The Checking of Hardwood Ties

A feature which causes some concern during the seasoning and after treatment is the checking or opening up of all hardwoods. The present practice is to apply "S" irons immediately when any checking is noticed. Some of the American roads apply "S" irons on all ties as soon as they are made, but the objection to this practice is that these irons may very often be found to be in the wrong position and labor and material are wasted.

B. M. Winegar, assistant to the president of the Canada Creosoting Company, of Montreal, conceived the idea of incising hardwood ties while green for the purpose of reducing the tendency to check. After going through the adzing and boring and incising machine, the ties were stacked in the yard and after being properly seasoned, it was found that these ties had not developed any large checks, but instead the faces of the ties were covered with small almost hair-like checks. A careful study of this method is being made by J. F. Harkom, superintendent of the Forest Products Laboratories at Ottawa.

Reference was made above to the purchase of both sawed and hewed ties but the treatment of ties is bringing about radical changes of opinion with respect to their relative merits. Square sawed No. 1 ties are preferred for treatment for the following reasons:

(1) Waste of timber is eliminated, the side cut of the log being utilized for lumber, etc., instead of being left in the woods in chips as is the case in ax-made ties.
(2) A tie of uniform size, straight and true, is obtained, which permits uniform treatment, as most of the sap wood has been removed. Ties so made are straight and can, therefore, be uniformly spaced.
(3) The shoe of the rail anchor obtains full bearing on a sawed tie, whereas on an ax-made tie its bearing is on a curved surface and causes breakages and bending of the anchor shoe.
(4) Ties with a face the same width as the tie plate (which is 7 in. and 7½ in.) should not be treated and as long as ax-made ties are manufactured, No. 1 and No. 3 ties must necessarily be produced as they cannot be left in the woods.

The wood-preserving industry has developed tremendously during the past few years and, while railways are still the largest users of treated materials, the commercial business is increasing, so that today we have the railways using treated ties, switch ties, bridge timbers, piling, fence posts, roofing materials, car lumber, etc., and the telephone and telegraph companies treating poles, cross-arms, top pins and brackets.

Train Derailed By Flood Water

THE derailment of a passenger train on the Chicago, Rock Island & Pacific near Stratton, Colo., on July 18, 1929, resulted in the death of eight passengers, two Pullman porters and the injury of 80 passengers. The accident occurred at 3:55 a. m., at bridge 474.1, which consisted of an 85-ft. deck plate girder span supported on concrete U-abutments, spanning a dry wash, the embankment at the ends of the bridge being about 30 ft. high.

The wash was dry normally, and testimony at the investigation indicated that for at least 25 years the depth of water in the channel had never exceeded two to three feet. About three years prior to the accident, in connection with improved road construction; a highway bridge was located on the south or upstream side of the railway, 170 ft. distant and approximately opposite the east abutment of the railway bridge. The piers of this bridge did not conform to the direction of the channel, but were placed at right angles to the highway and railway.

Shortly before the arrival of the train, a cloudburst had occurred over the drainage area of the wash at a point about 20 miles above the railway. This precipitation, while heavy, amounting to more

A View of the Two Bridges as Restored After the Flood

This view, which was taken from the south or upstream side, shows the relative heights of the two embankments. The railway span was replaced by a pile trestle, while the two east highway spans destroyed were partially replaced by a temporary timber span.

than 5½ in. in a period of three hours, was entirely local, there having been no indications of a storm in the vicinity of the railway. An eastbound passenger train passed over the bridge in question about 3:07 a. m., at which time there was no water in the wash. At the time of the derailment, 48 min. later, the water was 15 ft. deep and flowing at a high velocity.

The train involved in the accident, consisting of 12 cars, 8 of which were sleeping cars, was being double-headed and was derailed at bridge 474.1 while traveling at a speed of 50 to 55 miles an hour. The bridge collapsed after the engines and the first five cars had crossed it.

The officers of the railway contended that the highway bridge was the primary cause of the erosion of the embankment, since this bridge was not in the natural channel of the stream, and the piers were so placed as to divert the water against the embankment at the point where it was washed out.

In his report, James E. Howard, engineer-physicist of the Interstate Commerce Commission, does not support this view, but attributes the accident to the use of U-abutments. "Wing walls of abutments," he said, "are carried in oblique directions, the lengths of which have a relation to the height of the embankment. A current of water striking an oblique surface is deflected chiefly in one direction, with wing walls, forward. A current of water striking a flat surface, normal to it, is deflected in each direction. In the case of a U-abutment some of the flowing water is deflected toward the channel, some in the opposite direction against the embankment. Against the wash of embankments, abutments with oblique wing walls present better conditions than the U-type. The latter might be considered an obsolete type. In the present case, a minimum amount of concrete was used in the U-walls. The abutment walls are shown on the blueprint furnished, as resting upon piles, and approximately 13 ft. lower than the U-walls. The bottom of the U-wall was only 2.6 ft. below the openings of the new highway bridge. The channel of the creek was scoured out 7.5 ft. below the bottom of the concrete U-wall. Still, the bottom of the concrete abutment was about 5½ ft. below the scoured channel or pocket, as it seems to have been under the bridge, and its stability was undisturbed. It does not seem to admit of doubt that the undermining of the railroad embankment was influenced by the flat U-wall of the east abutment. The degree with which it had an influence on the derailment would be a matter of judgment, after weighing the evidence of other possible contributory causes. Nevertheless, it appears one of the vital causes, if not the only one."

W. P. Borland, director, Bureau of Safety, Interstate Commerce Commission, reaches the following conclusion: The cause of the derailment was the undermining and weakening of the track structure at the east end of bridge 474.1 by flood waters. The reason for the derailment is obvious, but opinions differ as to the reason why the east embankment was attacked and undermined. The officers of the railway were in accord that the presence of the highway bridge was the vital reason. The report of Col. Charles H. Rankin to the public utilities commission of Colorado does not attach vital importance to the presence of the highway bridge, expressing the belief that the washout would have taken place had there been no highway bridge above the railway. The engineer-physicist reached a similar conclusion. Each was aware, however, that the disposition of the piers of the highway bridge would have a deflecting effect upon the direction of the current, but regarded this as a secondary matter; negligible, in fact.

The railway embankment had a damming effect, increasing the velocity of the waters between the abutments. The result was the scouring of a deep pocket under the bridge. These circumstances support the theory that the principal, if not the sole, cause of the weakening of the track structure was due to the high stage of the creek.

What's a War Department For?

The story is told of Theodore Roosevelt, that when he was organizing his Rough Riders at the outbreak of the Spanish-American war, he could get no help from the war department in outfitting his regiment. After meeting with indifference from everyone he approached, he finally went to President McKinley, who gave him an order on the secretary of war for everything Roosevelt wanted.

On his way back to the war department, he ran afoul of a certain bureau chief whom he had encountered earlier and who resented having to change the routine of his department to meet the requirements of war. His comment was something like this: "It is a rotten shame to have to change our way of handling things; here I had the department working nicely until this war came along and turned everything upside down."

One would imagine that the war department existed to assist in conducting a successful war, if one should materialize. The bird mentioned above evidently figured that it was maintained so that he and others like him could develop and maintain a nice office organization.

Those of us responsible for track maintenance make the same mistake at times. We figure that the purpose of railroading, in so far as we are concerned at least, is to maintain good track. As a matter of fact, track maintenance is only incidental to the main purpose of railroading, which is to serve the public with transportation efficiently and economically. Certain things we do may be first class for the track itself but those things may not fit in just at that time with the most satisfactory transportation service; and if they do not they are out of place, regardless of how good they are for the track itself.

Orders frequently come that to some of us appear more or less out of reason, but the man who issues the orders is responsible also for other things than the track and he has struck a balance that is going to be best for the railroad as a whole, even though the execution of the order may work a hardship temporarily on the track department.

When we get an order to do something, let's do it just as cheerfully as if we were following our own ideas. Let's not pull back like a balky mule until some one builds a fire under us. A good soldier does what he is told promptly and without grumbling.

How One Division Engineer Talks to His Men

One of a series of monthly bulletins addressed to the foremen on the Northern division of the Frisco

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The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of October			10 Months Ending with October		
	1929	1928	Increase 1929 Over 1928, Per Cent	1929	1928	Increase 1929 Over 1928, Per Cent
Total operating revenues	$608,661,330	$618,759,938	1.6*	$5,383,774,295	$5,160,626,176	4.3
Expenditures for maintenance of way and structures	**79,205,309**	**78,817,298**	**0.5**	**734,704,749**	**717,853,902**	**2.3**
Total operating expenses	404,326,989	402,161,432	0.5	3,818,702,640	3,748,579,124	1.9
Net railway operating income	152,987,127	165,623,281	7.6*	1,113,439,327	986,170,728	12.9

*Decrease.

To Which System
Was Your Road Assigned?

Interstate Commerce Commission issues plan for consolidating railways of United States into 21 separate groups

PURSUANT to the requirements of the Transportation Act of 1920, the Interstate Commerce Commission has issued a plan for the consolidation of all of the railways of the United States into 21 separate systems, including two Canadian-controlled groups. The plan as proposed comprises five systems in the Eastern district, two in New England, three in the South, five in the West and Northwest, four in the Southwest and the two Canadian roads.

In the East, the New York Central and the Pennsylvania remain substantially as they now are, but each is to receive a large number of small local short lines, the Virginian also being added to the New York Central. The new Wabash system is made up of almost an entirely new grouping, and will extend from Florida to the Missouri river. The Baltimore & Ohio is to receive the Reading, the Central Railroad of New Jersey and the Buffalo, Rochester & Pittsburgh, while the Delaware, Lackawanna & Western is to be added to the Chesapeake & Ohio and other roads now in the Van Sweringen group.

In the Northwest, the Great Northern and the Northern Pacific are to be combined into one group, the outstanding provision of the plan for this territory being the exclusion of the Chicago, Burlington & Quincy, now controlled jointly by these roads, which is used as the nucleus of a separate system.

The plan does not contain a complete allocation of terminal properties, the commission saying that in its opinion "All terminal properties should be thrown open to all users on fair and equal terms, so that * * * every carrier shall have access to all terminal tracks in the terminal area."

In order to effectuate the plan as proposed, certain trackage rights will be necessary and these are indicated in detail in the plan which, as to important roads, is as follows:

System No. 1—Boston & Maine

Boston & Maine; Delaware & Hudson; Bangor & Aroostook; Maine Central and 23 other short lines.

System No. 2—New York, New Haven & Hartford

New York, New Haven & Hartford; New York, Ontario & Western; Lehigh & Hudson River; Lehigh & New England; New York Connecting Railroad (undivided one-half interest) and 6 other small roads.

System No. 3—New York Central

The New York Central System, including the Boston & Albany, the Michigan Central, the Cleveland, Cincinnati, Chicago & St. Louis, the Cincinnati Northern, the Pittsburgh & Lake Erie, the Evansville, Indianapolis & Terre Haute, and in addition, the Virginian, the Rutland, the Ulster & Delaware and 41 other short lines.

System No. 4—Pennsylvania

The Pennsylvania System, including the Long Island, the West Jersey & Seashore, and the New York Connecting Railroad (undivided one-half interest), together with 55 additional short lines.

System No. 5—Baltimore & Ohio

The Baltimore & Ohio; Reading; Central of New Jersey; Buffalo & Susquehanna; Staten Island Rapid Transit; Chicago & Alton; Buffalo, Rochester & Pittsburgh; Detroit, Toledo & Ironton (undivided one-half interest); Detroit & Toledo Shore Line (undivided one-half interest); Chicago, Indianapolis & Louisville (undivided one-half interest); Atlantic City and 52 other short lines.

System No. 6—Chesapeage & Ohio-Nickel Plate

Chesapeake & Ohio (excluding Chesapeake & Ohio of Indiana); Hocking Valley; Pere Marquette; Erie; Delaware, Lackawanna & Western; New York, Chicago & St. Louis; Bessemer & Lake Erie; Chicago & Illinois Midland; Detroit & Toledo Shore Line (undivided one-half interest); New York, Susquehanna & Western; New Jersey & New York; Pittsburgh & Shawmut and 40 other small roads.

System No. 7—Wabash-Seaboard

Wabash; Lehigh Valley; Wheeling & Lake Erie; Pittsburgh & West Virginia; Western Maryland; Akron, Canton & Youngstown; Ann Arbor; Chesapeake & Ohio of Indiana; Norfolk & Western; Seaboard Air Line; Detroit, Toledo & Ironton (undivided one-half interest) and 38 additional small lines.

System No. 8—Atlantic Coast Line

Atlantic Coast Line; Louisville & Nashville; Nashville, Chattanooga & St. Louis; Clinchfield; Atlanta, Birmingham & Coast; Gulf, Mobile & Northern; New Orleans Great Northern; Chicago, Indianapolis & Louisville (undivided one-fourth interest); Charleston & Western Carolina; Mississippi Central and 49 other small roads.

System No. 9—Southern

Southern; Norfolk Southern; Florida East Coast; Chicago, Indianapolis & Louisville (undivided one-fourth interest); Georgia & Florida; Tennessee Central, Nashville to Harriman Junction; and 38 other short lines.

System No. 10—Illinois Central

Illinois Central, including the Gulf & Ship Island, the Yazoo & Mississippi Valley, the Central of Georgia and the Vicksburg, Shreveport & Pacific; Minneapolis & St. Louis; St. Louis Southwestern; St. Louis Southwestern of Texas; Louisiana Railway & Navigation Company of Texas; Tennessee Central from Nashville to Hopkinsville; and 35 additional roads.

System No. 11—Chicago & North Western

Chicago & North Western; Chicago, St. Paul, Minneapolis & Omaha; Chicago & Eastern Illinois; Mobile & Ohio; Columbus & Greenville; and 16 other roads.

System No. 12—Great Northern-Northern Pacific

Great Northern; Northern Pacific; Spokane, Portland & Seattle and 28 other short lines.

System No. 13—Milwaukee

Chicago, Milwaukee, St. Paul & Pacific; Duluth, Missabe & Northern; Duluth & Iron Range and 16 additional small roads.

System No. 14—Burlington

Chicago, Burlington & Quincy; Colorado & Southern; Fort Worth & Denver City; Quincy, Omaha & Kansas City; Missouri-Kansas-Texas; Missouri-Kansas-Texas of Texas; Trinity & Brazos Valley (undivided one-half interest) and 27 other short lines .

System No. 15—Union Pacific

The Union Pacific System, including the Union Pacific, Oregon Short Line, Oregon-Washington Railroad & Navigation Company, Los Angeles & Salt Lake, and St. Joseph & Grand Island; Kansas City Southern; Utah; and Bingham & Garfield (undivided one-half interest) together with 29 smaller roads.

System No. 16—Southern Pacific

The Southern Pacific System, including the Pacific Lines, lines in Texas & Louisiana, and the Texas & New Orleans;

Northwestern Pacific; San Diego & Arizona; the Nevada Northern and 55 other short lines.

System No. 17—Santa Fe

The Atchison, Topeka & Santa Fe System, comprising the Atchison, Topeka & Santa Fe, the Gulf, Colorado & Santa Fe, the Panhandle & Santa Fe, the Kansas City, Mexico & Orient and the Kansas City, Mexico & Orient of Texas; Chicago Great Western; Midland Valley and 21 other lines.

System No. 18—Missouri Pacific

The Missouri Pacific System, including the Missouri Pacific, the Gulf Coast Lines which also include the Beaumont, Sour Lake & Western, the New Orleans, Texas & Mexico, the International-Great Northern, the St. Louis, Brownsville & Mexico and San Antonio, Uvalde & Gulf; Texas & Pacific; Western Pacific; Denver & Rio Grande Western; Denver & Salt Lake; Bingham & Garfield (undivided one-half interest) and the Kansas, Oklahoma & Gulf and 66 other short lines.

System No. 19—Rock Island-Frisco

Chicago, Rock Island & Pacific; Chicago, Rock Island & Gulf; St. Louis-San Francisco; St. Louis-San Francisco of Texas; Louisiana & Arkansas; Louisiana Railway & Navigation Company and 35 other small lines.

System No. 20—Canadian National

Canadian National Lines in New England; Central Vermont; Grand Trunk Western and five other lines.

System No. 21—Canadian Pacific

Canadian Pacific Lines in New England; Minneapolis, St. Paul & Sault Ste. Marie; Duluth, South Shore & Atlantic; Spokane International and two additional lines.

Railways Award Prizes

SUPPLEMENTING the report of the annual track inspection on the Pennsylvania, appearing in the December issue, we present statements below covering the outcome of the inspection on three other roads, the Lehigh Valley, the Canadian Pacific, Eastern Lines, and the Norfolk & Western. Particulars of the prize awards on other railways will appear in subsequent issues.

Norfolk & Western Gives 86 Prizes

Eighty-six section foremen on the Norfolk & Western received awards ranging from $40 for a first prize to $10 for a fourth prize, as the result of the annual track inspection held during October. The ratings of the various sections, subdivisions and divisions are established by committees of roadmasters, 10 representing a perfect score. The highest rating, 9.47, was given to Section 3, District 14, in charge of A. C. Davis. Next in order was Section 8 in District 19, in charge of M. Brumley, with a grade of 9.45; Section 15, District 17, T. S. Faulkney, and Section 17, District 12, Sam Jones, were each given a score of 9.42.

Roanoke Terminal, with a grade of 9.22, had the highest rating of any division, while the Tug Fork branch and the Clinch Valley line each received a grade of 9.28, the highest given to any roadmaster's district. The Scioto division showed the greatest improvement over the previous year with a grade of 9.20 compared with 9.03 for 1928, while the Naugatuck-Kenova subdivision of this same division showed the greatest improvement among subdivisions, with a rating of 8.55 in 1928 and 9.13 in 1929.

Canadian Pacific Awards $1,100

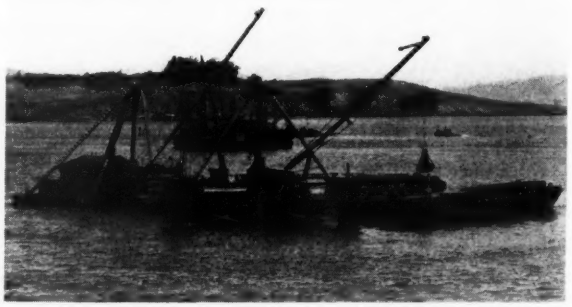
The "general manager's" prize of $100 for the section having the highest rating on the Eastern lines of the Canadian Pacific was awarded to V. Newman, section foreman at Lake View, Me., on the Mattawamkeag subdivision, Brownville division, New Brunswick district. This was the largest prize award as the result of the annual track inspection, there being, in addition, four "general superintendents'" prizes of $50, 14 "superintendents'" prizes of $25 and 45 "roadmasters'" prizes of $10, which were awarded to the foremen whose sections received the highest ratings on each district, division and subdivision, respectively. The winners of the four "general superintendents'" or district prizes were: H. Crouse of the New Brunswick district, Woodstock division, Gibson subdivision at Zealand, N. B.; R. Shaw of the Quebec district, Smiths Falls division, Chalk River subdivision at Chalk River, Ont.; T. Lannin of the Ontario district, Trenton division, Oshawa subdivision at Leaside, Ont.; and M. Pickarchuk of the Algoma district, Chapleau division, White River subdivision at Wayland, Ont.

Lehigh Valley Announces Ratings

Although the Lehigh Valley does not award prizes in connection with the annual inspection, the results of the inspection are tabulated and distributed among all of the maintenance of way forces. As a result of the inspection in 1929, the Buffalo division, of which E. J. Cullen is division engineer, received the highest rating for the second consecutive year, having been given a grade of 99.56 per cent. The Seneca division, of which R. E. Patterson was division engineer until recently when he was transferred to the New Jersey and Lehigh division, received the second highest rating of 99.54 per cent, advancing to this position from fourth place in 1928. The third highest rating of 99.45 per cent was given to the New Jersey and Lehigh division, of which J. F. Donovan was division engineer until his recent promotion to assistant chief engineer of maintenance.

The results by subdivisions gave the subdivision of W. W. Crowley, supervisor on the Seneca division, the highest rating of 99.71 per cent, and the subdivision of W. F. Nichols, supervisor on the Buffalo division, the second highest rating of 99.65 per cent. The subdivision to receive the third highest rating was that of C. Hewitt, supervisor on the Seneca division, the rating of this subdivision being 99.60 per cent.

That there was keen rivalry in the inspection on the Lehigh Valley is seen by the fact that the ratings given to the five divisions on the road vary only from 99.36 per cent to 99.56 per cent, and that the ratings given to the 10 subdivisions vary only from a lowest rating of 99.29 per cent to a highest rating of 99.71 per cent. The average for the road as a whole in 1929 was placed at 99.48 per cent, as compared with system averages of 99.52 per cent in 1928, 99.25 per cent in 1927 and 99.22 per cent in 1926.



Constructing the Piers for the Southern Pacific's Suissun Bay Bridge

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE MARCH ISSUE

(1) *What methods can be used to protect joint ties from the effects of creeping rail?*

(2) *Where treated timber is used in wooden trestles is it permissible to use drift bolts for attaching the stringers to the caps? If not, how should this be done?*

(3) *In what way does a split head rail differ from a piped rail? What are the indications of each?*

(4) *What are the desirable maximum and minimum heads for water columns from the standpoints of efficiency and maintenance? How are these affected by the relative positions of the tank and water columns?*

(5) *Under what conditions is it desirable to use guard rails on curves? Can the allowable speeds be increased on guarded curves?*

(6) *Under what conditions is it permissible to support a steel span on pile piers?*

(7) *What precautions can be taken during the winter to insure that culverts will offer free passage for melting snow in spring thaws?*

(8) *What are the relative advantages and disadvantages of assigning both bridge and building work to the same gang?*

Bolting Rail Joints

When applying fastenings to rails, should the bolts at the middle or those at the ends of the joints be tightened first? Why?

Bolts Should be Tightened Uniformly

By H. R. CLARKE
General Inspector Permanent Way, Chicago, Burlington & Quincy, Chicago

The proper application of angle bars to rails is one of the important details which must be watched carefully during any rail laying operation. The fit of the angle bar and the seating and adjustment of the angles of the bearing surface of the bar to those of the rail, as intended in the design of the bar, have much to do with the wear and life of the angle bar, and also of the rail itself.

If the angle bar is seated improperly, or "cocked" as it is sometimes called, the contact or bearing of the angle bar on the rail, instead of being of considerable area, will be a line. This will be particularly noticeable at the top or head of the bar, where, in the head contact type of angle bar, the bearing surface area is approximately ⅝ in. in width and the length of the bar generally 24 in. or more. If, by incorrect seating, this is reduced so that it becomes practically a line bearing, wear will naturally be much more rapid, resulting in rapid decrease in the efficiency of the angle bar and very speedily causing the bolts to loosen, which in turn makes necessary additional work in tightening the bolts or, if neglected, results in more serious and rapid wear.

In connection with all rail laying operations, the application of the bars is a feature that is watched closely at all times and, in connection with this, some observations have been made of various procedures in tightening the bolts. Any information that we have been able to develop has led to the conclusion that the fit or seating of the angle bars is affected very little, if any, by the order in which the bolts are tightened; that is, whether the middle bolts or those at the ends of the joints are tightened first. It is necessary that the angle bars be seated square and true and then, as the bolts are tightened and the bars pulled into final position, they should be tapped on the base and very lightly on the head, never in the middle, to assist the tension of the bolts in bringing the bars to final position.

In our opinion, the best results will be obtained by tightening all of the bolts in the joint uniformly, that is, bringing each bolt in order to the same tension, as nearly as possible, giving each nut two or three turns with the wrench and then passing to the next bolt. In the final tightening, that is, when practically the desired tension has been put on the bolt, the amount that each nut can be tightened and turned is materially reduced and not more than a quarter turn should be possible.

It is desirable that the tension on all the bolts in the joint be as nearly uniform as possible and it is our opinion that, if tightened as outlined, this uniform tension will be more nearly approached than if one or two are tightened up in advance of the others. If either the center or the end bolts are tightened first, there is a strong probability that the tension on one pair will be greater than on the other. It is also probable that the tension on the bolts tightened last will be greater than on those first set up, for the reason that the tightening of the last bolts will increase the tension on the bars, pulling them into closer contact with the rail and resulting in the lessening of the tension on the bolts which were first tightened.

In observations of various methods of tightening bolts, we have been unable to discover any advantage

in tightening any pair of bolts in advance of any others. The work is in no way speeded up or expedited and such check of joints as has been made afterward has convinced us that the uniform tightening of all bolts gives better and more permanent results.

If any bolts in the joint are to be tightened ahead of any others, and so result in a greater tension on some bolts than others, it is our opinion that the center bolts should be tightened last. The reason for this is that the wear on the center of the bar is greater than at the ends and the force exerted on the center bolts by the impact of the passing wheels undoubtedly is greater than at the ends. It is our opinion, therefore, that, if there is to be any difference in the tension, the center bolts should be tighter to start with.

If a type of nut lock or coil spring washer is used which engages only one bolt, any method of tightening desired can be followed. However, if a type of joint spring which engages two or more bolts is used, it is most important that all of the bolts engaged by any one joint spring be brought up to as nearly uniform tension as possible. With the four-hole angle bar, which is in most general use, and joint springs engaging two of the four bolts, if the tightening is not done uniformly it results in the bolts in one end of the bar being brought up tight ahead of those in the other end, and we think this is objectionable.

With present day axle loads and train speeds the impact on the joint is such that the support of all the bolts in the joint is necessary. If the tension on any of the bolts is greater than on the others, the result naturally will be that the tightest bolts will take the greatest amount of strain; this will almost certainly result in over stressing them and in that way decrease the efficiency of the joint.

For the reasons already outlined, it is our opinion that, in retightening joint bolts which is necessary periodically, the wrench should be applied to each nut in turn and the bolt tightened and this repeated two or three times as may be necessary, depending on the looseness that has developed, bringing the bolts to the desired tension.

Uniform Tightening Is Most Important

By M. M. Backus
Assistant Engineer Maintenance of Way, Illinois Central, Chicago

Because of the importance of a properly maintained joint, I have discussed this question with a number of our division engineers and track supervisors. I find that there is a decided difference of opinion as to which bolt should be tightened first. While some of these officers are of the opinion that the end bolts should be tightened first, others are as fully convinced that the middle bolts should be the ones to be tightened first. In these discussions no sound reasons were advanced which would justify establishing a definite rule requiring either method to be followed.

In my opinion with the 24-in., four-hole angle bar which we are using on our heavy section rail, it is immaterial which bolts are tightened first, but it is of extreme importance to have a uniform tightening to secure an even fit throughout the entire length of the bar and to distribute the work equally to the four bolts. Furthermore, if one bolt is tightened ahead of the remainder of the bolts in the joint, it may result in injury to the thread on that bolt.

Care should be taken to insure the removal of any accumulation of dirt or rust from the end of the rail within the area of the contact of the angle bar. The use of a brush and the application of crude oil will add life to the joints as well as to the rail.

In tightening bolts it is good practice to use a spike maul, tapping the bolt lightly to set it thoroughly in the rail joint before the last two or three turns of the nut are made. These observations apply to the original application of the joints to the rail, to the second tightening made at a short interval after the rail is laid and to any further tightenings that may be made.

Timber Trestles of Mixed Material

Is it permissible to construct a timber trestle partly of treated and partly of untreated material? If so, under what conditions?

Advisable if Economy Warrants

By H. Austill
Bridge Engineer, Mobile & Ohio, St. Louis, Mo.

It has been demonstrated beyond any question of doubt that the use of creosoted and other forms of treated timber is economical. This being so, if one cannot afford to build a trestle entirely of treated timber, certainly it would be economical to use as much of it as possible.

In certain instances, on the Mobile & Ohio, we have used creosoted piling, with creosoted caps, and untreated stringers, ties and guard timbers. This has proved to be very good construction, but, of course, it would have been better if we had used decks of the same material rather than of the untreated material.

It Is Both Permissible and Economical

By F. H. Cramer
Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Several years ago we had a number of untreated, open-deck timber trestles at widely scattered points on the system in which the caps, stringers, ties and guard rails were in excellent condition, and capable of running for a long time, with ordinary attention. The piles were partially decayed, however, and in need of renewal. After a thorough investigation, it was decided to renew the pile bents, including the caps and sway bracing, with treated material and allow the decks to remain in place until they had lived their service life.

The caps and brace plank were carefully removed and sorted; such of the material as was fit for further use was preserved and used later in making running repairs to other structures for which it was suited. The piles were cut off and new treated piles were driven, and capped and braced with treated timber. This work was done beginning in 1913, and extending to 1919. A number of similar structures on the line through the Black Hills in South Dakota had been partially rebuilt in the same manner some years earlier, beginning in 1903.

Because of the favorable climatic conditions, none of the bridges in the Black Hills have required any further attention, so far as renewals are concerned. The first of the structures which were treated in this manner from 1913 to 1919, now require renewal of the decks, and this is to be done during the coming year. Although the total number of structures involved in the entire program is quite large, only 30 are scheduled for attention during 1930, the remainder being in such condition that they will last from one to ten years longer.

Inspection indicates that a considerable part of the timber in the decks of those structures in which the decks are to be renewed in 1930 is in suitable condition for further use, and it is proposed to follow the

procedure which was established in the renewal of the bents. The timber will be inspected and sorted as it is removed, and the sound material will be used for running repairs to replace occasional unsound units in other structures.

It is planned, in renewing these decks, to use treated material throughout, including the stringers, ties and guard rails. Some idea of the magnitude of the program which was followed and the economies which were involved can be obtained when it is understood that these structures ranged in length from 7 to 54 panels or 98 to 756 ft., with a few as short as 5 panels or 70 ft. The Burlington has found that this practice, under the conditions which existed at that time, was not only permissible but that it demonstrated marked economy. We have secured a minimum of 13 to 16 years additional life from our untreated decks, and the pile bents as they now stand give evidence of being good for an indefinite period. If untreated piling had been used, of the character we were able to secure at a reasonable cost, at least one and perhaps two additional drivings would have been necessary.

Tie Stocks During Winter

What is the minimum stock of ties that should be carried on an outlying section during the winter? What determines this?

Minimum Stock Should Be Fifty Ties

By G. M. O'Rourke
District Engineer, Illinois Central, Waterloo, Iowa

The minimum stock of ties that should be carried on an outlying section during the winter depends upon the latitude in which the railroad lies. In the south where ties can be inserted the year around, there need be little difference in the number kept on hand during this season of the year. Where the track is frozen for several months during the winter, arrangements need be made only for sufficient ties to afford protection in case of derailments and to remove an occasional broken end tie. Probably 50 ties to the section will suffice on the outlying sections, with a reserve of several hundred at terminals where they can be loaded quickly and sent out in an emergency.

An effort should be made by the stores department to deliver at least one car load, say 400 to 500 ties, on each section during the winter in cold climates so there will be a good supply on hand when the frost goes out. To insure complete renewals early enough in the summer to allow preparations to be made for the winter, at least one-half the annual tie allowance should be on hand by March 1, unless it is known that the stores department can keep ties coming as required.

Local conditions and the policy on each railroad control the situation. Some roads use the small labor force that must be kept on during the winter to unload and pile ties where they will be used during the open season. Others do not distribute many ties on the line, preferring to store them at the treating plant and send them out as called for. Each system has its advantages.

A Minimum Stock Is not Always Warranted

By Supervisor of Track

It is assumed that the question has reference to railways in the northern territory where it is not practicable to attempt tie renewals because of the frozen condition of the ground and ballast during the winter months. In sections where excessive heaving occurs, it is sometimes necessary to superimpose a full tie, or one that has been partly framed, over several of the ties that are in service in the track, in order to keep it in safe condition. While this is not an ordinary or a desirable situation, it is one that must be met, and every section that has such conditions to overcome should have sufficient ties on hand to meet its needs.

About the only other necessity for ties on outlying sections during the winter is to have them on hand for use in emergencies. For this purpose I would set the minimum stock at 50 ties. This estimate is based on the assumption that all conditions are normal, so that special requirements may necessitate an increase in this minimum stock. In my opinion, however, any attempt to hold the stock of ties on all sections down to a minimum is not warranted. In most cases ties can be distributed during the winter as economically as during the more favorable seasons and, if done at this time, the work of distribution is out of the way and does not interfere with the work of tie renewals and ballasting when these operations are fully under way.

Furthermore, if the foremen on the various sections have enough ties on hand early in the spring, they can follow out the program which has been adopted for the season without having their schedule interrupted by a lack of ties. In this way the whole maintenance program for the season can be carried out in a more orderly and economical manner than is otherwise possible.

Incrustation of Discharge Lines

Can the incrustation of discharge lines at water stations be prevented or reduced? If so, how?

Incrustation Is an Annoying Problem

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

The incrustation of discharge lines at water stations is one of the most annoying problems which arises in connection with the lime-soda water softening process. Engineers familiar with water softening methods are well aware that this trouble can be eliminated completely, but we are usually confronted with the all important question: Will the cost be justified?

Incrustation of pipe lines, in the sense that tuberculation takes place and certain kinds of debris more or less colloidal in nature collect on the wall of the pipe, is as old as the use of pipe, and this probably has led some persons to assume that, if the water from a lime-soda softening plant is made perfectly clear and free from any suspended matter, no incrustation can take place. Desirable as such qualities are in a softened water, they do not completely solve the problem, as incrustation will still persist to some extent.

The reason for this seems to be that incrustation is not a mechanical phenomenon, but is due to chemical reactions which cause the deposition of minute crystals of calcium or magnesium carbonate. Under some conditions the incrustation will be dense and smooth but usually it is more or less gelatinous in form, by reason of the large percentage of water held within the mass. Analysis of this form of incrustation, which may fill up a small pipe line rapidly, shows in some cases that the body of the material contains as high as 90 per cent of water.

In the ordinary cold lime-soda process, which is usually the most practical method where large quantities of water must be softened, about the best that can be expected is a softening down to the point of 1.5 to 2.5 grains of hardness. In order to accomplish this, and to be assured also that no lime hardness remains to clog the locomotive injectors or cause other trouble,

it is usually necessary to use an excess of sodium carbonate. If we add the refinement of filtration after the softening process, it is possible to reduce the hardness to approximately one grain. This is practically the ultimate limit for the lime-soda process, because we then closely approach the solubility point of calcium carbonate, which is generally agreed to be about ¾ of one grain.

Even under this condition of one-grain hardness, incrustation is still found to accumulate in certain pipe lines, and we are forced to the conclusion that incrustation from a properly softened water may continue just as long as any normal calcium carbonate remains in the solution. This may be explained by the theory of ionic equilibrium, the excess of sodium carbonate ions in the softened water forcing out of solution the calcium carbonate which under other conditions would remain completely soluble and cause no trouble. The separation seems to take place most readily under the influence of a change in temperature, and so we find this incrustation occurring frequently near where cold treated water enters a comparatively warm underground pipe line or in the pipe lines of a heated building, the temperature of which is higher than the water from an underground pipe line.

Recarbonation of a softened water, thereby changing the comparatively unstable, normal carbonates to the stable bicarbonate form, is one method which has been carried out very successfully to permit the softening of a large city supply and yet eliminate any incrustation difficulties. This, however, is a refinement usually considered impracticable for the amount of water used at a railway water station, and there may also be some objection to the addition of carbon dioxide to a water where corrosion conditions are one of the features sought to be corrected by water treatment.

Where other conditions are suitable, softening by the zeolite process may be found desirable. One of the distinct advantages of this method is that it provides a water of practically zero hardness and also one which is in the bicarbonate form, thereby eliminating any tendency toward pipe line incrustation.

Depends on Eliminating the Cause

By R. C. Bardwell
Superintendent of Water Supply, Chesapeake & Ohio, Richmond, Va.

The prevention or reduction of incrustation in discharge lines at water stations depends largely upon the elimination of the cause. Pipe line incrustation is occasioned by the deposition of scaling matter caused by chemical reactions or change in physical conditions which promotes crystaline formations. If the incrustation results from acid, excess iron, or sediment in the water, these substances should be neutralized and removed as far as possible. If the incrustation is caused by after-precipitation in treated water transfer lines, as a result of incomplete chemical reactions in the softening plant, improvement may be effected by proper formula changes and possibly by the use of a coagulant such as sodium aluminate to hasten the reactions.

It should be understood and expected that pipe line incrustation will result if chemicals are added direct to the water in the pipe line or through the pump, and if this is sufficiently aggravated to warrant the expense, suitable external treatment facilities will provide remedy. Incrustation frequently occurs in pipe lines subjected to fluctuations in temperature which exert an influence on the crystalization point of the soluble chemicals. Such situations can be improved by providing suitable insulation for the lines affected if the expense is found warranted. Owing to the variety of causes, the prevention or reduction in the incrustation of pipe lines should require special study of the individual situations and the most suitable remedy applied which is found warranted by the conditions.

Incrustation Only One of Three Related Problems

By Engineer of Water Service

Incrustation is only one of the three causes of increased frictional loss and decreased flow in pipe lines carrying untreated water. The three classes or causes of dirty water mains are incrustation, growths, and deposits or sedimentation, and it is assumed that the intent of the question is to cover all three causes rather than incrustation alone.

Incrustation takes place primarily when the water comes in actual contact with the metal of which the pipe is composed. Upon examination, coated pipe will usually show in the first stages of incrustation that nodules of rust are formed at places where the coating has been disturbed. Therefore, incrustation is the direct product of corrosion. In many cases it will be found that active corrosion is taking place under these nodules. The writer has in mind a six-inch fire protection line which was so badly incrusted on the interior that its carrying capacity was reduced very materially. At the same time, the pipe was pitted through in many places and was in such condition that it was necessary to renew it. Incrustation may be prevented either through treatment of the water by chemicals or by maintaining an unbroken coating on the interior of the pipe.

Growths in water mains are caused by what are generally termed biological reactions of the water. These growths are credited very largely to the various forms of crenothrix which feed upon the iron contained in the water. Other growths are pipe moss and sponge, which are living organisms and are dependent for food upon still other organisms carried in the water. The growth of pipe moss and sponge can be prevented by filtering the water, as filtering removes the organisms upon which they feed.

Deposits in the pipe line are caused by the deposition or sedimentation of suspended matter. This sedimentation usually occurs at low points in the line or where the velocity of flow is not sufficient to keep it in suspension. Where incrustation or the formation of pipe moss or sponge occurs in the pipe line, it is sometimes further aggravated by suspended matter which combines with the incrustation or other obstruction in the pipe line and further decreases its carrying capacity. Maintaining the proper velocity of water in mains which are otherwise clean, and the location of blow-offs at low points, will do much to prevent the accumulation of suspended matter in the pipe line.

Another cause of dirty water mains, which perhaps is the most serious of all, should properly be called scaling and occurs in pipe lines carrying water treated by lime, soda ash and other similar chemicals. It is due to the precipitation of the chemicals remaining in the water after treatment. In the ordinary treatment of water with lime and soda ash, the period of reaction and sedimentation is usually from four to five hours. In some cases the remaining hardness may be four or five grains, and under the most favorable condition the hardness of the treated water will be from one to two grains. The chemical reaction is seldom complete when the water passes into the main and, as the reaction continues to take place, the objectionable chemicals are thrown out of the water and adhere to the walls of the pipe, thus causing the formation of scale, reducing the

carrying capacity of the pipe and increasing the frictional loss. As the after-precipitation and resultant formation of scale are directly proportional to the residual hardness after treatment, it is apparent that the amount of scale formed on the interior of pipes carrying treated water will depend upon the degree to which the water has been treated and to the time allowed for reaction and precipitation.

Modern treating plants are reducing the hardness of the water to less than two grains, which should prevent the scale from forming very rapidly. Filtering the water after treatment is instrumental in further preventing the formation of scale. In some cities where the water is only partially softened, after-precipitation is prevented by recarbonization of the water which arrests the reaction and prevents the formation of scale.

Maintaining Main Tracks in Yards

Should a section gang in a large yard also be required to maintain the main tracks through or beyond the limits of the yard, or should this be assigned to a main track gang?

The Gangs Should Be Segregated

By T. F. Donahoe
General Supervisor of Track, Baltimore & Ohio, Pittsburgh, Pa.

Any large yard should be maintained by a yard gang with its own foreman, while the main track should have a gang with a main line foreman and main line men.

It is true that a first class track foreman can maintain both, as the principles involved are the same for both main and yard tracks, in that safe track, as to line, surface and gage, must be maintained in either place. Practice has shown that there is a real differentiation, however, and that a main line foreman and a yard foreman each do best in their own places. A good yard foreman is trained especially to do work under conditions found in yards and while he maintains safe track he usually fails to maintain his main tracks to the same standard as the foremen on each side of him do, so that he becomes discouraged and seldom does his best.

On the other hand, a great many good main line foremen who can maintain first class main track are failures when assigned to congested yards. Almost invariably they give the main tracks preference, thus causing trouble in the yards. The track men who are used to main line work are not as good in the yards, where traffic is congested. Likewise the yard trackmen are not as good on main track.

It is evident, and experience bears this out, that the yard foreman with his yard-trained trackmen does get more work done in the yard than a main line gang, but will not do as well on high speed tracks, as he is inclined to follow yard practice. The main line gang can be doubled up with other main line gangs at any time, when conditions make this desirable, and can follow a well defined program. In busy yards, however, every day finds its own troubles, so that a program is not so easily followed. In yard maintenance it is necessary to handle the work to suit the conditions as they develop day by day. In my opinion both main tracks and yards will be better maintained with the same force divided into two gangs than to have one large gang maintaining both.

The exception to this practice would be sections on industrial lines where the great number of switches and low speed operation make it all, in effect, one large yard, even if some of it is classed as main track. The same class of work is done on both. This kind of work requires a yard foreman. The length of this type of a section should be determined on equated values.

A Yard Should Be a Complete Unit

By Irving Anderson
Division Engineer, Atchison, Topeka & Santa Fe, Kansas City, Mo.

A section gang in a large yard should be given a section which is made up as nearly as possible of tracks of the same character. The main line tracks should be set apart in individual sections, and the yard tracks placed in sections by themselves; this statement is applicable generally. There is also to be taken into consideration, however, the question of convenience to the foreman in reaching all parts of his section, and the qualifications of the foremen, who are available for particular sections.

The maintenance of main tracks requires accurate work in surfacing and lining. A different kind of ballast is used for main line tracks from that which is found in yards. Different problems of drainage exist as between main line tracks and those on yard tracks, and one of the most important things to be considered is that different methods of handling the work under traffic on main lines must be followed, as compared with the methods which are suitable for yard tracks.

I believe one of the most important things in yard maintenance is to have foremen who have sufficient mechanical ability to keep the switches in good repair. After all of the conditions are considered, the best results will be obtained when the foreman is picked for the job, or the job picked for the foreman. This is less easy to do now than in past years; therefore, all the advantages possible should be realized by dividing the sections up, so that the same quality of work will be required throughout the section for proper maintenance.

The Work Falls in Different Classes

By S. A. Means
Section Foreman, Missouri-Kansas-Texas, San Antonio, Tex.

My experience of more than 20 years as a section foreman, yard foreman and general foreman in a large yard, has resulted in the very definite opinion that the maintenance of main tracks and yards, while based upon the same fundamental principles, fall into two quite distinct categories. The yard foreman is a specialist. He meets and solves constantly problems that never present themselves to the ordinary main line foreman. Yet he must know everything and be able to do everything that a main line foreman is called upon to do.

The average yard foreman should never be required to maintain high speed main tracks, however, since the requirements, as compared to those of low speed yard tracks, are so entirely different in character. In his experience he has been impressed with the importance of safe and substantial switch work and, usually, the major part of his time is applied to switch maintenance. It is true that he is aware of the importance of line and surface, and is an adept at detecting and correcting defects in both line and surface. But after all, line and surface in a yard, with the slower speed traffic, do not occupy the same important relation to the other work, that they do on high speed tracks, and for this reason there is always a slight tendency on the part of yard-trained foremen to neglect this feature of their maintenance when working on main tracks.

The main line foreman is trained to appreciate the importance of line and surface, as well as other items which affect the riding qualities of the track and the safety of high speed trains, many of which mean little to the yard foreman, unless he has had considerable experience in main line work. It is the almost universal experience that if a foreman, who has been trained in main line work, is placed in charge of a yard he will put an excessive amount of his time on the main tracks and neglect his yard work. In the same way the yard-trained foreman neglects his main tracks, in addition to which, when he does work on his main track he seldom works to as high a standard as he should. For these reasons it is desirable to segregate the two classes of work and assign to each, foremen who are specially trained in the different classes of work.

Uniform Painting Force

Is it desirable to maintain a uniform force of painters throughout the year, and if so, what painting can be done during the winter?

Winter Conditions May Compel Reduction of Force

By C. S. Robinson
Engineer Maintenance of Way, Maine Central, Portland, Me.

Considerable progress may be made along this line. I believe it is essential that the painting program be arranged definitely and sufficiently in advance, so that a crew can move into a territory and clean up the structures there, thus eliminating the necessity of sending another crew back into that territory later. Working on this consideration, when the weather forces us to discontinue outside work, we reduce the crews to small organizations sufficient to do the building interiors scheduled in the following season's program, with the intention of finishing the interiors before the full crew starts out in the spring. This expedites the work during the summer months, and in many respects winter is the best time to do the interiors. This system also has the advantage of retaining the best men in the crew and keeping them together as a permanent organization. Very often large interior jobs may be left until winter weather forces the crews inside.

A Uniform Force Is Desirable

By E. C. Neville
Master of Bridges and Buildings, Canadian National Railways, Toronto, Ont.

It is not only desirable but practicable to maintain a uniform force of painters throughout the year on building painting, but not so practicable in the case of painters used exclusively on bridge painting.

It is just as desirable to maintain a uniform force of painters throughout the year as it is to maintain uniform forces in any other branch of railway work, for the same obvious reasons. One of the great advantages of such practice is that it overcomes the necessity of hiring new men every spring, many of whom have so little experience that the season is well advanced before they become of much use, thus adding unnecessary expense to the normal cost of painting.

Permanence of employment attracts a better class of men, creates a feeling of security in their positions and relieves domestic worries, resulting in greater efficiency.

For paint gangs doing building work only, it is not difficult to program the season's work so that, during the most severe period of the winter, they can be kept busy on the interior decorating of station buildings, motive power offices, freight offices, stores and other buildings.

For gangs which are used for both building and bridge painting, the program of the year's work can be so arranged that the summer months, which are suitable for bridge painting, be set aside for the undisturbed performance of that class of work, the interior painting of buildings to be done during the severe period of winter and the exterior building work to be done in the spring and autumn before and after the bridge program has been disposed of.

It is more difficult to arrange a program of continuous painting for gangs that are engaged on bridge work only, except on roads favorably situated as to climatic conditions.

On roads in the more northerly territories, where this class of painting cannot be carried on throughout the year, the gangs usually can be absorbed into the regular bridge repair crews after the painting season closes, providing the maintenance program for the year has been prepared with this in view.

Reducing Rail Wear on Curves

What method, if any, can section forces use to reduce the rail wear on curves?

Section Forces Can Assist Materially

By A. A. Johnson
Track Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

The section forces can do much to reduce the rail wear on curves by giving particular attention to the condition of the track, and by keeping it in first class riding condition at all times. One of the important factors in reducing rail wear to a minimum is the maintaining of the proper superelevation of the outer rail of the curve, adjusted to best suit the degree of curve and the traffic to be carried. Insufficient elevation may cause excessive wear of the outer rail, while too much elevation on a line that carries a large volume of slow-moving traffic causes the metal in the low rail to flow.

The maintenance of good line and surface will tend to reduce the rail wear, since either poor line or poor surface causes considerable oscillation of the car trucks and wheels while passing around the curve. This not only increases the total wear, but also results in wear that is not uniform, while there is also danger of causing the rail to bend in line or surface.

If the tension of the bolts in the joints is maintained at the correct value, so as to permit the joint fastenings to function properly, and all bolts are under uniform tension, there will be a noticeable reduction in the wear at the rail ends. Of no less importance is the position of the vertical axis of the rail. This axis should be kept approximately vertical with the plane of the track, varying from this position only by the amount which is required for inward canting (1:20 or 1:40) of the rail to conform to the contour of the car wheels.

Good Track Is Important

By Roadmaster

There are many things which can be done by the section forces to reduce the wear of the rail on curves, but when they are summed up they can be reduced to the simple formula of doing all of the things which are required to maintain good track elsewhere. Of equal importance with most of the other items to be considered, is that of the gage, which should be uniform throughout the curve, and should not be permitted

to become greater than the allowable limit at any time. Uniform gage tends to keep the wear uniform.

A curve that is not maintained in first class line and surface usually shows considerable lack of uniformity in the amount of wear at different points throughout its length. Wherever rail does not wear uniformly it is safe to predict that the amount of wear is greater than it should be.

The foremost contributing cause to rail wear on curves is incorrect superelevation. This is a feature which is not controlled by the foreman, but he should endeavor to maintain the elevation which he is instructed to place on each curve. Where two or more speeds of traffic are carried on the same track, it is necessary to provide sufficient elevation to assure the safety of high speed trains, which, in most cases, is in excess of that required for slower trains.

The section foreman should watch closely the rail wear on his curves to insure that it does not exceed the allowable limit. When it has reached this point, he should at once notify his superior officer so that the rails can be reversed and brought to the proper gage.

Oiling the Rail Is an Important Method

By Division Engineer

The most important requirements for reducing the wear of the rail on curves, so far as the section forces can meet them, consist of maintaining good line and surface, proper gage, tight bolts and, most important of all, the correct elevation of the outer rail, adjusted for the curvature and varying speeds of traffic. All of these presuppose clean ballast and adequate surface drainage, both of which are, in most instances, the direct responsibility of the section forces.

There is an additional method, however, which can be followed by the section forces, but for which they must usually secure authority from the supervisor. This is the oiling of the gage side of the head of the high rail on the curve. Where this is done, and if the oil is of the proper quality, there is invariably a marked reduction in the amount of wear on this rail. Better results can be obtained if the oil is applied to the flanges of the wheels, and there are a number of satisfactory flange oilers on the market, but where such devices are not in use, the section forces can apply the oil by hand to the side of the rail with excellent results.

In making such application by hand, it is desirable to wait until some initial wear is evident, since the wheel flanges have little contact with a new or unworn rail and will not pick up the oil until the rail is slightly flange worn. The frequency of application will depend upon the amount and character of traffic, climatic conditions, the gradient and amount of curvature.

It is necessary to apply the oil more frequently in territory where there are many sharp curves, than where the curvature is light and constitutes only a small part of the mileage. During the winter, less frequent oiling is required than during the summer, since snow and rain afford considerable lubrication to the rail, while the oil is not carried away as rapidly in cold weather as during periods of high temperature. For the same reason, on descending grades, where brake applications are frequent, or where retainers are turned down, the wheels are heated and the oil is used more rapidly.

Ordinary black oil is not satisfactory for this purpose, and the oil used for this form of lubrication should be a special oil, several brands of which are on the market. This method of reducing rail wear on curves is not new as it has been used for a number of years by several of the larger roads, the records demonstrating a marked increase in the life of the rail with a corresponding reduction in the labor and cost of maintenance.

Provisions for Inspecting and Painting of Bridges

What provision should be made on truss and girder spans and viaduct towers to facilitate access to all parts of the structure for inspection and painting?

Not Necessary on Ordinary Structures

By H. T. Welty
Engineer of Structures, New York Central, New York

On the New York Central Lines East, we have never made any special provision for the inspection and painting of ordinary structures and I doubt very much whether such facilities would be warranted because of the extra cost. In the case of certain structures, it would be entirely impracticable to do more than, possibly, to make certain parts of the structures more accessible for an inspector.

For an ordinary deck plate girder bridge it is not a difficult matter to sling a small amount of scaffolding from which the painters can work and, ordinarily, an inspector can either reach the steel by a ladder from the ground or can work his way out through the spans on the lateral bracing. In the case of an ordinary truss bridge, an inspector has no particular difficulty in getting over the trusses and, no matter what extra provisions might be made, it would still be necessary to hang scaffolding for painters.

There are, of course, special cases where some extra provision for inspection and painting is warranted. I thought that our bridge over the Hudson river at Castleton, N. Y., was one of these. The viaduct approaches are long and 150 ft. high and, because of the magnitude of the structure, we installed walkways along the bottom flanges of the girders, which not only permit ready inspection of the girders but also enable painters to work with freedom. An inspector can readily climb the viaduct towers, using the lattice bars as ladder rungs, except where the large gusset plates occur, and at these points special ladder rungs or hand holds were provided for the inspector's use. For the painting of these towers, however, scaffolding will be required, and scaffolding will also be required for painting the undersides of the bottom flanges of the girders.

On the trusses a hand rail was installed over the top chords, with ladder rungs up one end post of each span; ladder rungs were also installed over all large gusset plates. These provisions were made to facilitate inspection and are of no great assistance in maintenance painting.

Two Distinct Problems are Involved

By P. G. Lang, Jr.
Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

Two distinct problems are involved, one covering the periodical inspection of the structure, the other painting.

It is perhaps best to deal with the second problem first. It would seem to be impracticable to make adequate provision so that all parts of a bridge structure may be painted. Painting will always require scaffolding and, manifestly, it is not practicable to provide adequate permanent ladders or platforms so that every part of a structure can be painted from them.

Many structures, when properly designed and built, require little or no provision for inspection. It seems obvious that I-beam spans, through plate girder spans

and floor systems are of such a nature as to permit readily of inspection, considering always that the inspector should be a man of reasonable agility. Deck plate girder spans, unless they are long and, therefore, deep, particularly when they are provided with a bridge seat which is not pocketed by the backwall of the abutment and with a shoe of reasonable height, can be inspected readily by entering them from the abutment bridge seat, and inspecting the inside, using the bottom lateral system or cross-frames for assistance in moving about. Such spans may always be painted without difficulty and do not, therefore, require permanent staging.

In some few cases, where long and deep deck plate girder spans are involved, it is well to provide at one or more points a ladder reaching from the ends of the deck to the bridge seat of the abutment or pier.

Truss spans can be inspected easily by using the lacing of vertical or inclined web members as ladders for means of access to the top chord, in the case of through truss spans, or the bottom chord in the case of deck truss spans.

Viaducts are essentially a combination of truss construction, so far as towers are concerned, and deck plate girders so far as the carrying spans are concerned. The girders may be inspected in the manner already indicated for deck plate girder spans and the towers may be inspected as easily, by means of the bracing, as suggested for truss spans.

Generally speaking, therefore, it would appear that in only rare cases must provision be made for proper inspection of structures of this character, and in the few cases where provision is made, it is readily provided for at very small expense. Further, consideration should be given, when providing ladders, stairways and platforms to locate them so that they will not be readily noticed and used by trespassers or other unauthorized persons.

In the case of movable spans, where machinery is involved that requires frequent inspection, maintenance, lubrication, etc., it is necessary, of course, to give special consideration to the providing of proper and adequate ladders, stairways and platforms, which not only will give ready access for inspection, but which also will facilitate the necessary work on the machinery parts.

In the case of unusually large and important truss spans, consideration should be given not only to providing means of access for inspection, but also to providing light handrails.

Preparing Water Barrels for Winter

A further answer to the following question which was discussed in the December issue:

How should water barrels that are provided for fire protection on bridges be prepared for winter and by whom?

Fire Prevention Department Should Handle

By M. H. Doughty
Division Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

It has been our experience that steel barrels are more satisfactory than those of other types, and that in the fall they should be filled with water containing 2½ lb. of calcium chloride to the gallon. This will prevent the water from freezing at a temperature of about 10 deg. below zero.

In my opinion, it is the better practice to assign the responsibility for the inspection and handling of water barrels to the jurisdiction of the fire chief or other fire protection officers. As a rule, the fire department will have men employed whose entire work consists in fire prevention, and we believe that they are more likely to give matters of this kind adequate attention than our bridge maintenance forces, as there usually is a tendency on the part of the bridge maintenance forces to make the matter of fire protection incidental to their other work. Therefore there is a chance that the fire protection work will not be given sufficiently close attention.

Further, the fire department will ordinarily be held more directly responsible for fire hazards than will the bridge maintenance forces, and we believe that this is helpful in getting the work of inspection and maintenance that we require, given adequate attention.

Minimizing the Heaving of Track

A further answer to the following question which was discussed in the December issue:

What precautions, other than improved surface drainage, can be taken in the fall to prevent or minimize the heaving of track during the winter?

Permanent Relief Is Better

By C. S. Robinson
Engineer Maintenance of Way, Maine Central, Portland, Me.

The greatest factors that may be applied to reduce or prevent the heaving of track are good drainage, which includes both surface drainage and subdrainage, and an adequate section of good ballast. These two things, more than any others, will give the greatest relief.

Permanent relief in any amount cannot be obtained in a short fall season prior to freezing up, but should be the result of study during the winter and spring months, and an adequate remedy programmed and applied.

We have found that the installation of perforated corrugated drain pipe is of considerable benefit, and in some obstinate cases we have dug out the subgrade two feet below the ballast section and put in two feet of locomotive ashes. This, with two feet of rock ballast and good subdrainage, gives excellent results.

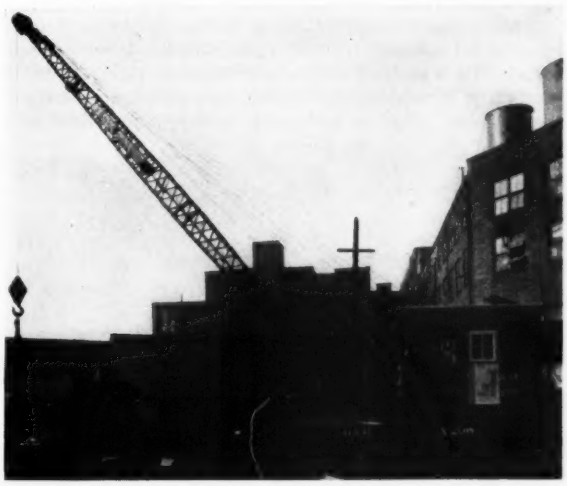
The expense incurred by heaving track warrants careful study and the necessary expenditure to relieve the conditions insofar as possible.

The Chicago Daily News Building Built Over Part of the Chicago Union Station Tracks

New And Improved Devices

A New Diesel-Operated Crane

A 25-TON capacity locomotive crane is now being introduced by the Industrial Brownhoist Corporation, Cleveland, Ohio, which is said to be the first crane of its capacity to be powered by a Diesel engine. The engine is of the six cylinder, two cycle, solid injection type and burns any ordinary grade of fuel oil. The entire operating mechanism of the crane is mounted on a one-piece, cast steel rotating bed and is equipped with



The New Industrial-Brownhoist Crane

cast steel side frames. The power transmission is fully enclosed, runs in oil and is equipped with Timken roller bearings to minimize friction and to reduce noise. Because of its low operating cost and ability to start and stop quickly, it is expected that this crane will effect marked economy in service.

A New Rotary Grinder

THE Chicago Pneumatic Tool Company, New York, has recently introduced the first of a line of pneumatic tools to be manufactured by that company embodying the application of the rotary principle. It is a portable tool grinder actuated by the action of compressed air on four vanes which rotate on a spindle in a casing having suitable openings for the admission and escape of the air. It is said that painstaking care in design has resulted in a high degree of uniformity in the distribution of the air and, therefore, in a high operating efficiency. For this reason the power per pound of weight is also high.

The grinder rotor is mounted on ball bearings with double radial and thrust ball bearings at the wheel end.

The No. 88 Grinder with a Pistol Grip

It is governor controlled, has a removable air strainer and is provided with an automatic oiler for the rotor. The tool, which is designated as No. 88, is available with a pistol grip, as shown in the illustration, or with a straight handle. It is furnished with either a six-inch or eight-inch wheel guard.

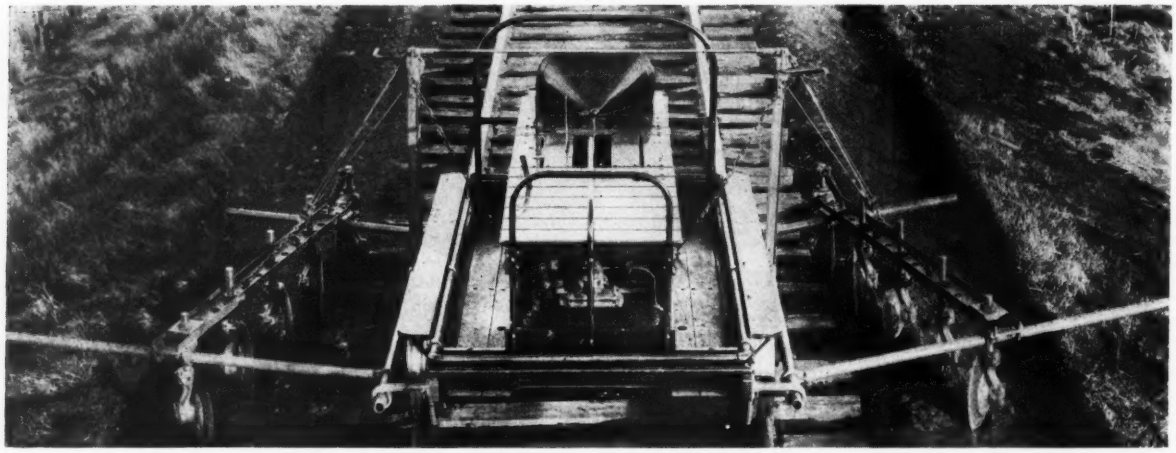
Fairmont Discing Equipment

FAIRMONT Railway Motors, Fairmont, Minn., have developed a new discer which consists of the Fairmont M25 discing equipment used in conjunction with the Fairmont A5 large extra gang motor car. The combination is continuously serviceable, either as motor car or discer and quick convertibility favors early and frequent discing.

The discing equipment consists of a discer arm on each side, with five discs to the arm, each disc being equipped with two Timken tapered roller bearings. These arms can be taken off or put back in five minutes and are held in place by five pins and two hooks. In order to reduce the detrimental effects of irregularities in the height of the ballast, the discs are arranged longitudinally, and, owing to floating action in the beams, there is less tendency to raise all discs out of the ballast if one of them strikes a high spot. All discs are individually adjusted for height and angle of cut in order to produce any desired contour. The self-adjustment of the disc beams, in following the general profile and contour of the shoulder, obviates the necessity of stopping the car to change the pitch of the discs if the slope of the shoulder changes appreciably. Sod lines can be cut rapidly by removing all but one or two outer discs.

The inner of colter disc on each side is adjusted for pitch to aid in cutting close to the ties. This disc is so mounted that when it strikes a projecting tie it swings out without injury and is forced back in place by a heavy spring. The low point of attachment, close coupling and wedge action of the diagonally-set discs reduce the effort necessary to keep the discs at the proper depth in the ballast. Since there is no continuous shaft through the discs, no trouble is experienced by weeds winding up near their concave or ploughing face.

This equipment is easily operated by three men and there is no necessity of men riding over the discs,



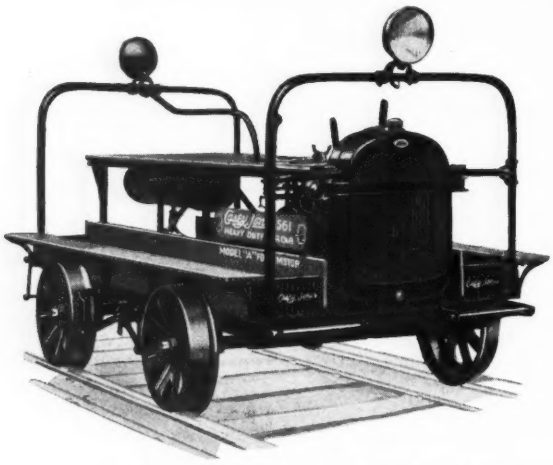
Fairmont M25 Discing Equipment on A5 Car

as they function satisfactorily without weights and are easily cranked up to clear obstructions such as cattle guards and buildings. Little storage space is required and the entire discing equipment can be hung or stacked in one corner of a tool house above four square feet of floor space.

Power is furnished by a 33 hp. Continental Red Seal H9 Industrial motor, and suitable gear reductions for any kind of discing are provided by three speeds on Timken bearings in the Brown-Lipe transmission. The ball and roller bearing reverse gear allows all three speeds to be used backward when it becomes necessary to clear trains. This discing equipment may be installed successfully on other motor cars having no less power than the Fairmont A5 car.

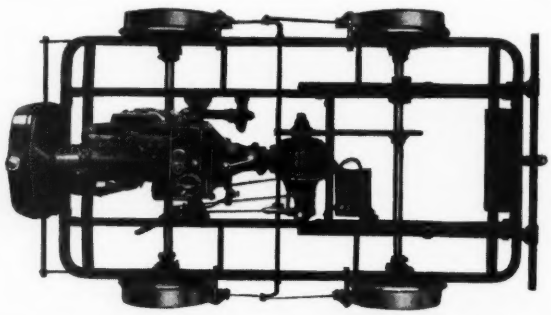
Heavy-Duty Car Has Self-Starter

THE Northwestern Motor Company, Eau Claire, Wis., has developed a new heavy-duty motor car, designated as the Casey Jones 561 and embodying several new features, the most distinctive of which is the use of the Ford Model "A," 40-hp. motor, together with the standard Ford battery ignition, self-starter and radiator. This car is designed to transport extra gangs, bridge crews and other large groups, and may be used in signal and hump-yard service and for operating discing and mowing machines. It has seating space for 12 men and a direct load capacity of 6,000 lb., and, when used with trailers, will haul 250 men.



The Casey Jones 561 Heavy Duty Motor Car

An exclusive feature of this car is the use of a special directional-transmission mechanism in addition to the standard Ford transmission and gear shift, by means of which the operator is enabled to shift to forward or reverse instantly without possibility of harming the gears. Thus three speeds in reverse as well as forward are attained. This mechanism consists of a small bevel gear on the end of the power transmission shaft from the universal joint, which meshes with one or two beveled ring gears rigidly connected to a cross shaft which, by means of a chain drive, transmits the power to the rear axle. By means of a one-lever control, the small bevel gear is made to engage one or the other of the ring gears, thereby determining the direction of the car. The control lever is cross-connected to the clutch which it automatically disengages during the process of changing the direction of the car.



Showing the All Steel Frame, Ford Engine, Radiator, Battery and Directional Transmission Arrangement of the 561.

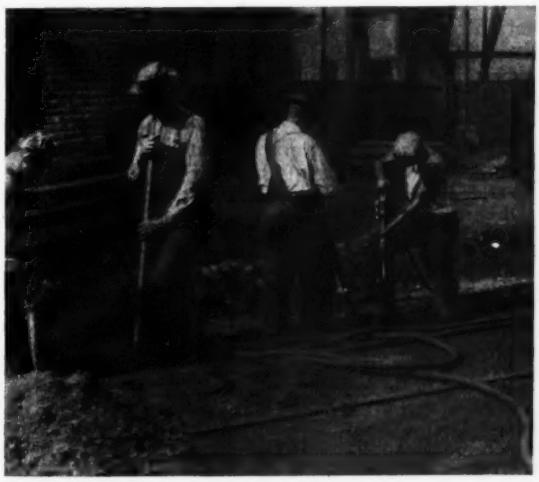
Four-wheel brakes, comprised of hardwood shoes set in malleable backs, with toggles adjustable for wear, constitute one of the features of the car. Its net weight is 2,025 lb., and the lifting weight of one end with the steel lift handles extended is 400 lb., enabling two men to handle it at grade crossings or motor-car set-offs. Other features are an adjustable malleable drawbar on the rear end; rachet pressure grease cups on all bearings; three insulated wheels; steel extension lift handles; tool-tray guards and deep

spacious tool trays; all-steel frame; Timken tapered roller bearings; safety steel step-ons at the rear end; adjustable brake links; all-metal tool box; aluminum radiator guards; steel safety railings at front and rear, and dash control.

A Pneumatic Clay Spader

THE Sullivan Machinery Company, Chicago, has introduced the improved Sullivan compressed air spader, designated as the Class M-1, for use in excavating stiff clay. This tool consists of a light Sullivan air hammer weighing 25½ lb. and requiring a ½-in. air hose. The body or stem of the hammer is in the shape of a cylinder and is provided at one end with either a single or double grip handle fastened to it by side rods, and at the other a clamp type retainer for holding the spade in the chuck of the hammer. The hammer or piston runs up inside a hollow cylindrical or shell valve and thus provides a long stroke without excessive length of tool or undue weight. The drill is operated by a thumb throttle at the top of the handle grip, although a push-down throttle and a palm-grip throttle are also available.

The tool retainer is made with a clamp bolt which fits a groove cut across the lower part of the cylinder, and the removal of this single bolt allows the retainer to be removed and a new spade or cutting tool inserted. The retainer is equipped with a rubber buffer to prevent the collar of the spade from doing any damage



The Clay Spader Loosening Hard Packed Earth

when the tool unexpectedly penetrates soft ground or is operated with the spade not placed firmly against the work. The buffer in turn is protected by steel split rings which also facilitate the changing of tools and at the same time prevent clay or dirt from getting into the machine.

The spader strikes a hard snappy blow and satisfactory work may be done at any air pressure from 45 to 100 lb. per sq. in., although the higher pressures are recommended, particularly for stiff ground. The Sullivan 110 ft. WK-312 compressor will operate three or four spaders, while the 220-ft. WK-312 operates from seven to nine.

BELOW SEA LEVEL—The trainmaster's office at Indio, Cal., on the Southern Pacific, is probably the only one in the country situated below sea level. Just in front of the office is a neat sign bearing the inscription: "Indio, Cal., 22 ft. below sea level."

What Our Readers Think

Concrete Tanks—A Caution

Duluth, Minn.

To the EDITOR:

I have noted the editorial comment on concrete water tanks in your December issue and I think it covers the subject quite thoroughly. After the experience we have had with concrete tanks, as described by R. A. Tanner in the same issue, I feel that it is possible, under such conditions as we have, to construct concrete water tanks that are not only satisfactory but economical. However, this experience has made me realize that the greatest care must be used, not only in the design but in the construction of such tanks, and I would, therefore, not recommend them for general use unless I was sure that such care would be exercised. Any defects due to carelessness or lack of experience are almost sure to show up where all may see them.

W. A. CLARK,
Assistant to General Manager and Chief Engineer, Duluth & Iron Range.

The Force—Stabilization Problem in Argentina

Buenos Aires, Argentina.

TO THE EDITOR:

Having read with great interest various articles in *Railway Engineering and Maintenance*, and particularly H. S. Clarke's paper on "The Stabilization of Forces," I thought it might be of interest to some of your readers to know that in this country we are up against exactly the reverse of this problem. The difference struck me particularly in comparing conditions here with those obtaining in Canada where I used to work. There most of our gangs were reduced to a foreman and one or two men in winter, whereas here we have to do practically all of our work in the winter, as the peons get higher wages on harvesting work, and the various harvests keep them employed most of the summer. It should, of course, be understood that the weather in no way interferes with any kind of work, the winter being very mild and not unduly wet.

It may be suggested that we should do better to raise the wages of maintenance-of-way employees in order to keep them, but it has been found that, as there is only a comparatively limited supply of unskilled labor available in the country, it is much better for the railways to allow the majority to go to the harvest (which is by far the greatest revenue-producer we have), knowing that they will come back when the harvest is over. In this way, our gangs usually are reduced in summer to about the same size as we used to cut them to in Canada in the winter, and we have to program our work accordingly.

Another curious point is that, although a large majority of the thousands of immigrants (mostly from eastern and southern Europe) who enter this country every year go to work on section and extra gangs as soon as they land, agriculture is increasing at such a rate that the labor situation remains unaltered. Consequently, the only step that has been taken here (so far as I am aware) towards stabilization in the hope of retaining a few men from which

foremen can eventually be made, has been to establish a job of "permanent peon," with slightly increased pay, for which a peon may apply to the roadmaster after six months' continuous service.

ASSISTANT ENGINEER,
Central Argentine Railway.

Renewing Ties in Argentina

Buenos Aires, Argentina.

TO THE EDITOR:

Mr. Schram's reply to the question of inspecting ties for removal, which appeared on page 467 of the October issue of *Railway Engineering and Maintenance*, raises the further question as to what ties should be removed when ballasting or reballasting is being done.

In the interest of economy it has been my practice when placing or renewing ballast to leave in the track any tie that is good for a year or more, but to space out the poor ones as much as possible. I have not found that this practice is conducive to poor track. On the other hand, if one takes out a tie that is good for, say, two years, it is not worth while installing it in a siding, as the remaining service life does not pay for the handling, so that it becomes a dead loss.

In this country, most of our ties are made from quebracho, an extremely hard native wood, having a service life ranging from 20 to 40 years, so that it is unnecessary to give them preservative treatment, especially as they fail from mechanical wear and not from decay. We are exceptionally fortunate in the matter of ties for, while their first cost is approximately $7 ($3.08—United States currency), we get $1.50 (66 cents U. S.) apiece for most of them, for use as fence posts when they are removed from the track.

S. V. ARDAGH,
Assistant Engineer, Ferro Carril Central Argentino.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 21-23, 1930, Louisville, Ky.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 11-13, 1930, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 28-30, 1930, Seattle, Wash.

Bridge and Building Supply Men's Association—W. H. Lawrence, secretary, Johns-Manville Corporation, 41st street and Madison avenue, New York. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April 29-May 1, 1930, Memphis, Tenn.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 16-18, 1930, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

Illinois Central Station at Baton Rouge

WITH THE ASSOCIATIONS

American Railway Engineering Association

The publication of the committee reports to be presented at the annual convention to be held on March 11-13, 1930, is fully six weeks in advance of corresponding progress a year ago. Bulletin 320, containing reports of the committees on Standardization, Water Service and Sanitation, Grade Crossings, and Uniform General Contract Forms, has been in the hands of the members for several weeks, while Bulletin No. 321, containing the reports of the committees on Rules and Organization, Track, Roadway, Wood Preservation, Ballast, and Clearances, has just been mailed. Another bulletin, No. 322, containing the reports of the committees on Yards and Terminals, Records and Accounts, Shops, Iron and Steel Structures, and Economics of Railway Operation, is now in the hands of the printer and will be mailed early in January, while Bulletin No. 323, which will include the reports of the committees on Signals and Interlocking, Electricity, Masonry, Buildings, Economics of Railway Location, and Wooden Bridges and Trestles, will be placed in the hands of members about the middle of January. The last bulletin to contain committee reports, namely those of the Committees on Economics of Railway Labor, Ties, Rails, Rivers and Harbors, and Co-operative Relations with Universities, will be completed early in February.

The following members have been nominated for office for the year, beginning at the conclusion of the March convention of that organization:

President: G. D. Brooke, general manager, Chesapeake & Ohio, Richmond, Va.

Vice-President: J. V. Neubert, chief engineer maintenance of way, New York Central, New York.

Secretary: E. H. Fritch.

Treasurer: A. F. Blaess, chief engineer, Illinois Central System, Chicago.

Directors (three to be elected): W. C. Barrett, trainmaster, Lehigh Valley, Sayre, Pa.; C. R. Harding, assistant to president, Southern Pacific, San Francisco, Cal.; G. W. Harris, chief engineer system, Atchison, Topeka & Santa Fe, Chicago; J. C. Irwin, valuation engineer, Boston & Albany, Boston, Mass.; T. T. Irving, chief engineer, Central Region, Canadian National, Toronto, Ont.; C. R. Knowles, superintendent water service, Illinois Central, Chicago; H. L. Ripley, assistant to vice-president, New York, New Haven & Hartford, New Haven, Conn.; S. S. Roberts, assistant director, Bureau of Finance, Interstate Commerce Commission, Washington, D. C., and Hermann von Schrenk, consulting timber engineer, St. Louis, Mo.

Members of Nominating Committee (five to be elected): Lem Adams, general supervisor maintenance of way, Union Pacific, Omaha, Neb.; M. S. Blaiklock, assistant chief engineer, Canadian National, Montreal, Que.; P. M. Gault, signal engineer, Missouri Pacific, St. Louis, Mo.; M. S. Ketchum, dean, College of Engineering, University of Illinois, Urbana, Ill.; B. R. Leffler, bridge engineer, New York Central, Western Lines, Cleveland, Ohio; E. I. Rogers, president, Peoria & Pekin Union, Peoria, Ill.; H. M. Stout, record engineer, Northern Pacific, St. Paul, Minn.; J. R. Watt, general roadmaster, Louisville & Nashville, Louisville, Ky.; A. R. Wilson, engineer of bridges and buildings, Pennsylvania, Philadelphia, Pa., and Sidney Withington, electrical engineer, New York, New Haven & Hartford, New Haven, Conn.

The Board of Directors held a meeting at Washington, D. C., on December 18, to review plans for the convention. President Louis Yager, who landed at Seattle, Wash., on December 16, on his return from the World Engineering Congress at Tokyo, conferred

with Secretary Fritch at St. Paul on December 29, for the purpose of reviewing and releasing a bulletin containing the assignment of subjects to committees and the personnel of committees for the year 1930-31, preparatory to its distribution among the members.

This list of committees includes a new one, namely, the Special Committee on Maintenance of Way Work Equipment of which C. R. Knowles, superintendent of water service, Illinois Central, Chicago, has been appointed chairman. The personnel of committees also shows seven changes in chairmanships, the new chairmen being as follows: Ballast, A. P. Crosley, division engineer, Reading, Harrisburg, Pa.; Buildings, A. L. Sparks, architect, Missouri-Kansas-Texas, St. Louis, Mo.; Records and Accounts, C. C. Haire, auditor capital expenditures, Illinois Central, Chicago; Water Service, R. C. Bardwell, superintendent water supply, Chesapeake & Ohio, Richmond, Va.; Yards and Terminals, H. L. Ripley, assistant to vice-president, New York, New Haven & Hartford, New Haven, Conn.; Economics of Railway Labor, F. M. Thomson, district engineer, Missouri-Kansas-Texas, Denison, Tex.; and Shops and Locomotive Terminals, L. P. Kimball, engineer of buildings, Baltimore & Ohio, Baltimore, Md.

The Roadmasters' Association

A meeting of the executive committee was held at the Hotel Stevens, Chicago, on Saturday, December 7, to organize the work of the association for the new year, with President E. E. Crowley, Vice-Presidents E. T. Towson and C. W. Baldridge, Secretary T. F. Donahoe, and Directors P. J. McAndrews and E. P. Safford present. A report was presented from the hotel committee recommending that the next annual meeting be held at the Hotel Stevens, Chicago, which action was approved. After transacting other routine business, the committee devoted the major portion of the day to the selection of the personnel of committees to prepare reports for presentation at the next convention, on the subjects selected at the last annual meeting.

Bridge and Building Association

The members of the executive committee met at the Chicago Engineers' Club, Chicago, on December 14, with President J. S. Huntoon; Vice-Presidents C. S. Heritage and W. T. Krausch; Directors W. A. Batey, F. W. Hillman, J. E. King and E. C. Neville; Secretary-Treasurer C. A. Lichty, and Past-Presidents C. R. Knowles, F. E. Weise and Elmer T. Howson, present. After receiving and analyzing the report of the finance committee, the executive committee gave primary attention to the selection of the personnel of the committees which are to prepare reports.

Metropolitan Track Supervisors' Club

The last meeting of the Metropolitan Track Supervisors' Club was held on December 12, with 37 members and guests in attendance. A paper on "The Use of Labor Saving Devices" was presented by a committee consisting of F. W. Biltz, Reading, and E. H. Mills, New York Central. The next meeting of the club will be held on February 13, at Keen's Chop House, 72 West Thirty-sixth street, New York City.

Maintenance of Way Club of Chicago

At the meeting on December 18, Walter S. Lacher and George E. Boyd, managing editor and associate editor, respectively, of *Railway Engineering and Maintenance*, presented papers on the refinements necessary in the construction of roadbeds to minimize the difficulties of maintaining tracks upon their being placed in service. Abstracts of these papers will appear in a following issue.

The next meeting will be held on January 22 when B. T. Gibbs, Jr., works manager, Morden Frog & Crossing Works, Chicago Heights, Ill., will present a paper on the design of trackwork as influenced by problems of installation and maintenance.

Wood-Preservers' Association

The twenty-sixth annual convention will be held at the Olympic Hotel, Seattle, Wash., on January 28-30. The program is as follows:

Tuesday, January 28

Opening exercises.
Report of secretary-treasurer.
Report of Committee on Preservatives.
Address—Future Problems for Research, by Ernest Bateman, Forest Products Laboratory, Madison, Wis.
Address—Zinc Chloride as a Wood Preservative—Past, Present and Future, by L. C. Drefahl, Grasselli Chemical Company.
Report of Committee on Car Lumber.
Report of Committee on Treatment of Douglas Fir Lumber.
Report of Committee on Material Handling and Plant Operation.
Address—Fire Resistance of Wood Treated with Zinc Chloride and Ammonium Phosphate, by George M. Hunt, T. R. Truax and C. A. Harrison, Forest Products Laboratory.
Address—Preservative Treatment of Englemann Spruce Ties, by J. D. MacLean, Forest Products Laboratory.
Address—The Effect of Blue Stain on the Penetration and Absorption of Preservatives, by Wallace Marion Saling.

Wednesday, January 29

Report of Committee on Non-Pressure Treatment of Poles.
Report of Committee on Pole Service Records.
Report of Committee on Posts.
Address—Service Records of Treated and Untreated Fence Posts, by R. M. Wirka, Forest Products Laboratory.
Address—The Fraser River Bridge—Quesnel, B. C., by P. E. Philip, deputy minister and public works engineer, Department of Public Works, Victoria, B. C.
Address—The Use of Creosoted Douglas Fir on the Pacific Lines of the Southern Pacific Company, by W. H. Kirkbride, engineer maintenance of way and structures, Southern Pacific Company, San Francisco, Cal.
Address—Use of Creosoted Douglas Fir Piles and Timbers in Dock and Bridge Construction, by R. J. Middleton, assistant chief engineer, Chicago, Milwaukee, St. Paul & Pacific.

Thursday, January 30

Report of Committee on Tie Service Records.
Address—Why Is There a Termite Problem in California? by Chas. A. Kofoid, professor of zoology, University of California.
Address—Termites and the Retail Distribution of Treated Timber Products, by Merle Randall, professor of chemistry, University of California.
Address—An International Termite Exposure Test, by G. M. Hunt, Forest Products Laboratory, and T. E. Snyder, United States Bureau of Entomology.
Address—Studies of Heat Conductivity in Wood. Results in Steaming Round Southern Pine Timber, by J. D. MacLean, Forest Products Laboratory.
Report of Committee to Determine the Strength of Douglas Fir with Relation to Moisture Content.
Address—The Effect of Partial Seasoning on the Strength of Wood, by T. R. C. Wilson, T. A. Carlson and R. F. Luxford.
Report of Service Bureau Board.
Closing Business.

A special train will leave Chicago at 9:30 on Thursday morning, January 23, via the Chicago, Burlington & Quincy-Union Pacific, stopping enroute at the Galesburg, Ill., Laramie, Wyo., Pocatello, Idaho, and The Dalles, Ore., treating plants of these two roads and at the Long-Bell and Weyerhauser saw mills at Longview, Wash., arriving in Seattle on Monday evening, January 27.

RAILWAY NEWS BRIEFLY TOLD

Commissioner Frank McManamy has been elected chairman of the Interstate Commerce Commission for the ensuing year, succeeding E. I. Lewis, in accordance with the practice of the Commission to rotate the chairmanship annually.

Railways, as well as other corporations, will benefit by the one per cent reduction in the corporate income tax rate for 1929, provided in the bill signed by the President on December 16, in which the rate is reduced from 12 to 11 per cent.

Tom Vernon, who wrecked the Southern Pacific West Coast Limited near Saugus, Cal., on November 10, and who was taken to Los Angeles on December 10 for trial, was sentenced to life imprisonment on December 18. The former railroad fireman confessed that he wrecked the train for revenge, following the company's refusal to employ him because of a prison record.

Freight claims paid by the railroads during the first six months in 1929, growing out of loss and damage to freight shipments, were the lowest for any corresponding period in recent years, according to reports compiled by the Freight Claim division of the American Railway Association. Total payments were $18,510,038, compared with $18,834,897 for the first six months in 1928, and $19,820,223 for the same period in 1927.

The Interstate Commerce Commission has ordered a reopening for further argument at Washington on January 23, of the proceeding involving the ascertainment of the valuation for recapture purposes of the St. Louis & O'Fallon and the Manufacturers' railways. An opportunity will thus be afforded the various parties to present their arguments as to the methods which should be followed by the commission to make its valuation conform to the principles referred to by the Supreme Court in the decision in which it held that the commission had not given due weight to the cost of reproduction at the time which it proposed to use the valuation.

President Hoover on December 17 sent to the Senate the nominations of Joseph B. Eastman for reappointment as a member of the Interstate Commerce Commission and of Judge Robert Milton Jones, Knoxville, Tenn., for appointment to succeed Commissioner R. V. Taylor, whose terms expire at the end of the year. Judge Jones is serving the fifth year of an eight-year term as chancellor of the Tennessee court of chancery. Both appointments are for terms of seven years. Commissioner Eastman's appointment has been unanimously confirmed by the senate, but Judge Jones' name has been referred back to the committee for investigation, as some opposition developed among senators who had expected a Democrat to be nominated.

The government-owned Alaska Railroad had an operating deficit for the year ending June 30, 1929, of $950,711, according to the annual report of the Secretary of the Interior. There was a decrease as compared with the year before in revenues derived from the transportation of freight and passengers and the operating ratio increased from 159.32 in 1928, to 179.28 in 1929. Passenger revenue was $210,994, a decrease of 4.7 per cent, and freight revenue was $669,356, a decrease of 24 per cent.

In the hearing on a suit which seeks to enjoin the enforcement of the Arkansas full-crew law, requiring the employment of three brakemen on freight trains of more than 25 cars, Edward S. White, general attorney of the Missouri Pacific, in the Federal Court at St. Louis, Mo., on December 7, stated that this law costs the railroads operating in that state a needless expenditure of $1,000,000 a year, and that it costs the Missouri Pacific alone $600,000 a year.

A consignment of live foxes, the largest ever to be shipped out of this country and valued at $102,000, was recently billed from Seattle, Wash., to New York, with final destination, Hamburg, Germany. It consisted of an express carload of blue and silver foxes, being transported in 351 crates, and to be used for breeding purposes in Germany and Sweden.

An increase of 1.45 per cent in the number of employees of Class 1 railways and an increase in their compensation of 3.5 per cent for the month of September, 1929, over the same month of 1928, are shown by reports to the Interstate Commerce Commission. These roads report a total of 1,747,816 employees as of the middle of September and a total compensation for the same month of $248,012,305.

A recent decision by the Supreme Court of the United States held that the Interstate Commerce Commission does not have the power to compel the railways in any city to construct a union station. This decision was rendered in favor of the Atchison, Topeka & Santa Fe, the Los Angeles & Salt Lake and the Southern Pacific, and reversed the decision of the court of appeals of the District of Columbia, which held that these roads were subject to an order, which the California Railroad Commission and the City of Los Angeles, Cal., sought to have the commission issue, requiring the construction by these roads of a union station and the necessary connecting tracks at Los Angeles.

The Harriman Memorial medals, given annually in recognition of progress in the promotion of safety on railroads, have been awarded for the year 1928, as follows: Group A, gold medal, Union Pacific; Group B, silver medal, Duluth, Missabe & Northern; Group C, bronze medal, Texas-Mexican. Certificates of honorable mention were awarded as follows: Group A, Chesapeake & Ohio; Group B, Gulf, Mobile & Northern; Group C, Evansville, Indianapolis & Terre Haute. Group A includes railroads operating ten million or more locomotive miles in 1928; Group B from one million to ten million locomotive miles; and Group C, those operating less than one million. Of the 159 competing railroads in the three groups, 121 operated throughout the entire year of 1928 without a single passenger fatality. These roads reported more than ten billion passenger miles.

Commission Issues Consolidation Plan

The outstanding event of the month was the issue by the Interstate Commerce Commission of its plan for the consolidation of the railways in the United States, approximately 1,000 in number, into 21 systems, including the lines in this country which are owned by two Canadian systems. In the allocation, approximately 200 terminal properties and "bridge line" roads are not included, but are left for further consideration. The plan provides two systems in New England, five in the East, three in the South, five in the West and Northwest, four in the Southwest and the two Canadian-controlled systems. A notable feature of the plan is the grouping arrangement whereby present territorial lines are wiped out and existing systems are extended into sections where they now have no interest.

Construction News

The Atchison, Topeka & Santa Fe has let a contract to List & Clark, Kansas City, Mo., for the construction of 2.5 miles of line near Tecumseh, Kan., as part of a grade revision project in the vicinity of Topeka. The contract involves the excavation of 90,000 cu. yd. of material and the construction of two reinforced concrete bridges and a highway subway. This company, through the South Plains & Santa Fe, has been authorized by the Interstate Commerce Commission, to construct a line from Seagrave, Tex., westerly approximately 46 miles to Lovington, N. M.

The Canadian National has awarded a contract for the clearing of the right of way, grading and installation of culverts for the construction of an extension of the Uelfort-Ridgedale branch from Ridgedale, Sask., to a point about thirty miles north, to Stewart & Cameron, Ltd., of Winnipeg, Man. The cost of the line is estimated at $1,100,000. This company plans the construction of a hotel of the "Chateau" type at Saskatoon, Sask., at a cost of about $2,000,000, similar to the Chateau Laurier at Ottawa, Ont.

The Chesapeake & Ohio has let a contract to Board & Board, Charleston, W. Va., for the extension of its Gauley and Rich Creek line for a distance of approximately 5.5 miles from Marshall, W. Va. The estimated cost of the extension is $400,500. A contract has also been awarded to the Carpenter-Major Brothers Company, Clifton Forge, Va., for the rearrangement and construction of additions to present facilities at Big Island, Va., at a probable cost of $32,000. Examiner Ralph H. Molster of the Interstate Commerce Commission has submitted a proposed report recommending that the commission authorize the construction of an extension from a point near Edwight, W. Va., in a general southeasterly direction to a connection with the Piney Creek branch at or near Surveyor, 19.2 miles, on condition that the C. & O. grant to the Virginian, by means of trackage rights, full and equal access to all mines to be served by the extension and branches thereof, together with an option to acquire a half interest in the line at cost within ten years.

The Interstate Commerce Commission has authorized the Levisa River, a subsidiary of the C. & O., to construct a line from a connection with the C. & O. at Millard, Ky., eastward to the Kentucky-Virginia state line, approximately 28 miles, to cost approximately $4,804,000.

The Chicago, Burlington & Quincy and the **Colorado & Southern** plan the expenditure of $100,000 for the construction of an addition to the locomotive terminal at Twenty-third street and $100,000 for the construction of additional yard trackage at Thirty-first street in Denver, Colo., in 1930.

The Chicago, Rock Island & Pacific has awarded a contract to the Clinch-Mitchell Construction Company, Chicago, for the construction of a new single-track line between Nettleton, Mo., and Polo, 18 miles. This contract covers the second section of a new line from Coburn, Mo., to Kansas City.

The Delaware & Hudson has been ordered by the New York Public Service Commission to eliminate its South Grand, East and Grove street crossings in Cobleskill, N. Y., by carrying South Grand street under the tracks at a cost of approximately $237,000, and closing the East and Grove street crossings.

The Delaware, Lackawanna & Western has been ordered by the Public Service Commission of New York to eliminate the Bath-Avoca highway crossing of this company's tracks, two miles west of Kanona, N. Y.

The Denver & Rio Grande Western has included in its budget for 1930, $275,000 for the strengthening and replacement of bridges and culverts, $376,300 for the construction of additional yard and passing tracks, and $600,000 for miscellaneous improvements and betterments.

The Grand Trunk Western has been authorized by the Interstate Commerce Commission to operate by trackage rights into Muskegon, Mich., where the company announced its intention of spending $750,000 in the event that its application were authorized.

The Great Northern has let a contract to Peppard & Fulton, Minneapolis, Minn., for the construction of eight piling and timber crib piers and the false work which will support one timber span and three steel spans of a new bridge over the Columbia river near Marcus, Wash. A contract for the grading, which will be required in connection with the removal of the approaches from the old to the new bridge, has been awarded to the Morrison-Knudson Company, Boise, Idaho. The new bridge, which will be made up of a 150-ft. timber span, two 250-ft. steel spans and one 225-ft. steel span and pile approaches 700 ft. in length, will involve an expenditure of about $300,000. The erection of the bridge will be undertaken by company forces.

This road also plans the construction of a new freight station between Arizona and Utah streets at Butte, Mont., at a cost of approximately $200,000.

The Gulf & West Texas should be granted permission to build a line from Fredericksburg, Tex., to Brady, 69 miles, according to a recommendation submitted by Examiner J. S. Pritchard to the Interstate Commerce Commission, but that company's application to build a further line from Eden, Tex., to San Angelo, 44 miles, be deferred for further consideration.

The Lehigh Valley has been directed by the Public Service Commission of New York to eliminate Ellicott street crossing in Batavia, N. Y., by carrying the street under the grade of the railroad on the existing line. The cost, exclusive of land damages, is estimated at $125,000. The commission has also ordered this road to eliminate School House and Burtt's crossings, south of Ithaca, N. Y., by closing both highways and diverting traffic to a new highway to be carried over the grade of the railroad north of the present crossing. The cost of the work is estimated at $175,000.

The Long Island has been directed by the Public Service Commission of New York to eliminate the Deer Park avenue and Half Hollow road crossings of the Long Island, west of Deer Park station, Babylon, N. Y. The elimination of the former crossing will be accomplished by carrying the highway under the revised grade of the railroad at an estimated cost of $220,000, while the latter crossing is to be closed.

Bids are being received by this company for the elimination of a grade crossing at Main avenue, Douglaston, N. Y. The anticipated cost of the work, which involves changing the location of the avenue and carrying it over the tracks, is $450,000.

The Los Angeles & Salt Lake has awarded a contract to the Lynch Construction Company, Los Angeles, Cal., for the construction of a one and two-story brick and steel freight house unit, with outside dimensions of 70 ft. by 558 ft., at Los Angeles. The cost of the structure will be about $288,000.

The Missouri Pacific contemplates the construction of a locomotive terminal and shops near Topping and Nicholson avenues, Kansas City, Mo., dur-

A Grade Separation Program

A notable feature of the construction activity evidenced in the month's construction news, is the large number of grade crossing elimination projects either proposed or for which contracts have been awarded. In pushing its grade crossing elimination program, the Public Service Commission of New York has, during the last month, ordered the railways in that state to replace 18 grade crossings by suitable viaducts or subways costing nearly $2,000,000. Contracts involving the elimination of 15 other grade crossings over the country have been let during December to the amount of approximately $1,500,000.

Although construction authorized since December 1 will cost to exceed $25,000,000, authorizations for work not immediately necessary were held in abeyance during the month largely for the reason that the railways are now considering their annual budgets.

ing 1930, at an approximate cost of $750,000.

The New York Central has recently awarded contracts to the Pittsburgh-Des Moines Steel Company, New York City, for the manufacture, delivery and erection of a water treating plant at Churchville, N. Y.; to the Deline Construction Company, Watertown, N. Y., for the elimination of Kennies Crossing, Evans Mills, N. Y., at an approximate cost of $115,000; and to the Bates & Rogers Construction Company, New York City, for the elimination of the Nyack turnpike grade crossing in West Nyack, N. Y., at an estimated cost of $108,184.

The Oklahoma Southwestern, the Oklahoma Union and the **Fort Smith & Western** are roads which Charles Briggs, Tulsa, Okla., seeks to acquire in an application to the Oklahoma Corporation Commission for authority to construct and establish a line from McDonald county, in the southwest corner of Missouri, to Waurika, Okla. The new line would connect with the Kansas City Southern in McDonald county.

The Ozark & Philpot has applied to the Interstate Commerce Commission for authority to build a 7-mile line connecting with the Missouri Pacific at Ozark, Ark.

The Pennsylvania has recently awarded contracts to the H. R. Blagg Company, Dayton, Ohio, for the construction of a new freight station and team track facilities at Dayton, at an approximate cost of $208,000. Contracts have also been awarded to Newton A. K. Bugbee & Co., Trenton, N. J., for miscellaneous work at Trenton, at a total cost of $187,000.

The St. Louis-San Francisco includes in its 1930 budget the appropriation of $500,000 for the elimination of 22 grade crossings on its lines during 1930.

This company has awarded a contract for the construction of a reinforced concrete viaduct over its tracks at Boulder avenue, Tulsa, Okla., to the Standard Paving Company, Tulsa, at a cost of $140,200.

The St. Louis Southwestern has included in its budget for 1930, the expenditure of $283,200 for the construction of additions and improvements to bridges, structures and stations, $191,200 for river protection and the Cotton Belt's share of public improvements, $146,500 for the improvements of shops and engine house facilities, and $342,800 for additions to present trackage facilities.

The Texas & Pacific has been authorized by the Interstate Commerce Commission to construct an extension to its line from its terminus on the Texas-New Mexico state line northwesterly to Lovington, N. M., 70 miles, at an estimated cost of $1,825,000. This company expects to receive bids about January 1 for the grading of the right of way for the construction of this line.

Supply Trade News

General

Higgins & Co. have been appointed railway sales representatives of the **Gardner-Denver Company** for the Chicago district, and will hereafter handle the full line of railway equipment manufactured by the latter company.

The National Aluminate Corporation, Chicago, has opened an office at suite 1006, 11 West Forty-Second street, New York, **H. A. Marshall,** eastern railway representative, being in charge.

The Bethlehem Steel Corporation, through one of its subsidiaries, has entered into agreements covering the acquisition of all the properties and assets of the Pacific Coast Steel Company and the Southern California Iron & Steel Company. The properties to be acquired include steel manufacturing plants located at South San Francisco and Los Angeles, Cal., and Seattle, Wash. The plants have a steel ingot capacity of 380,000 gross tons a year.

Personal

Geo. C. Hannaway, sales manager of the **T. J. Moss Tie Company,** St. Louis, Mo., and **W. W. Davis,** superintendent at Cape Girardeau, Mo., have been elected vice-presidents with headquarters at St. Louis.

H. F. Miter, general manager of the Cleveland, Ohio, district of the **Austin Company,** Cleveland, has been elected vice-president in charge of foreign operations. **L. E. Cooney,** sales manager, has been promoted to assistant general manager of the Cleveland district.

Floyd K. Smith, for the past 11 years vice-president and treasurer of the **Donner Steel Company,** Buffalo, N. Y., has been elected president of the company and its subsidiaries, the **Donner Steamship Company** and the **Donner Ore Company,** succeeding **William H. Donner,** resigned. Mr. Smith has been associated with the iron and steel industry for 35 years. Following his connections with the Republic Iron & Steel Company and various companies, he acquired an interest in the Valley Mould & Iron Company in 1910, where he remained as vice-president until 1918, when he joined the Donner Steel Company.

William Paton Thomson, who resigned as vice-president of the Rail Joint Company on September 30, on account of poor health, died in the Atlantic City, N. J., hospital on December 21, after an illness of several months. Mr. Thomson was born on October 7, 1872, at Scotland, Pa. He graduated from Princeton University in 1896, and had devoted much of his time to the problem of railroad track construction. In 1880 he entered the service of the Pennsylvania and in 1914 he went with the Rail Joint Company as vice-president in charge of engineering and design. Mr. Thomson was the patentee of many railway devices.

H. M. Davison, eastern territory manager of excavator sales for the **Harnischfeger Sales Corporation,** has been promoted to general sales manager with headquarters at Milwaukee, Wis.

Irving T. Hartz, president of the Morden Frog & Crossing Works, Chicago, died on December 17, following an operation for an infected gall bladder. He was born in Peoria, Ill., on March 21, 1861, and, after a public school education, engaged in the grain business. Later he was in railroad service but resigned in order to assume charge of the offices and finances incident to the construction of the Croton Aqueduct in New York. From 1889 to 1892, he was secretary and manager of the Calumet Iron & Steel Co., and later he was appointed receiver. In March, 1896, he was elected vice-president and treasurer of the Morden Frog & Crossing Works, while from 1896 to 1899, he was also president of the Union Cold Storage Company and receiver for the James H. Walker Company. In 1907 he was elected president of the Morden Frog & Crossing Works, which position he held until his death.

Irving T. Hartz

A. F. Marwick, formerly general sales manager for the Pettibone Mulliken Company, has joined the Chicago district sales staff of the **Taylor-Wharton Iron & Steel Company** and **William Wharton Jr., & Co., Inc. G. V. Wood,** formerly located at the Highbridge plant of the Taylor-Wharton Iron & Steel Company, is now western sales manager for this company and its associated companies. Mr. Wood's headquarters will be in San Francisco. **J. R. Van Rensselaer,** sales representative with Taylor-Wharton's San Francisco distributor, has been transferred to the New York office of William Wharton Jr., & Co., Inc.

Personal Mention

General

J. H. Nuelle, vice president and general manager and formerly chief engineer of the New York, Ontario & Western, with headquarters at Middletown, N. Y., has been elected president, with headquarters at New York.

C. C. Cunningham, division engineer of the Kansas division of the Chicago, Rock Island & Pacific, with headquarters at Herington, Kan., has been promoted to trainmaster at the same place.

C. E. Adams, division engineer of the Philadelphia Terminal division of the Pennsylvania, with headquarters at West Philadelphia, Pa., has been promoted to superintendent of the Grand Rapids division, with headquarters at Grand Rapids, Mich. **J. L. Gressitt,** division engineer of the Ft. Wayne division, with headquarters at Ft. Wayne, Ind., has been promoted to superintendent of the Sunbury division, with headquarters at Sunbury, Pa.

Mr. Gressitt was born on April 4, 1887, at Baltimore, Md., and was educated at the Baltimore Polytechnic Institute and at Lehigh University, graduating from the latter with a degree in civil engineering. He entered railway service on the Pittsburgh division of the Pennsylvania on August 4, 1908, as a chainman and in less than a year he was promoted to rodman on the Monongahela division, being further promoted to transitman in the general offices at Philadelphia, Pa., in 1915. On May 1, of the same year, he was promoted to assistant supervisor on the Bellwood division and was later transferred to Williamsport, Pa., and to the Philadelphia Terminal division. From

J. L. Gressitt

October 1, 1917, to July 10, 1919, he was in military service with the 21st Engineers; on leaving the army he was made acting supervisor on the Monongahela division and was promoted to supervisor the next year, serving in this capacity during the next seven years on the Monongahela, Philadelphia Terminal and Pittsburgh divisions. He was promoted to division engineer of the Ft. Wayne division of the Western region on January 16, 1927, and remained in that capacity until his promotion to superintendent, effective December 1.

Carroll R. Harding, engineer of standards of the Southern Pacific, has been promoted to assistant to the president, with headquarters as before at San Francisco, Cal. While Mr. Harding will be charged with responsibilities as assigned by the president, he will continue his former duties in charge of the inspection of material and equipment for the system and will remain as chairman of the railroad's committees on maintenance of way standardization and on insurance. He was born at Hallowell, Me., on July 4, 1888, and graduated from a course in civil engineering at Cornell University in 1910. Before entering the employ of the

Carroll R. Harding

Southern Pacific, he was employed by the American Bridge Company and also made engineering surveys in Alaska, Costa Rica and Michigan. He entered the service of the Southern Pacific as draftsman and in February, 1914, he was advanced to chief draftsman. In 1916, Mr. Harding was promoted to assistant consulting engineer with headquarters at New York, and was further promoted to consulting engineer in June, 1923, with the same headquarters. In June, 1925, he was appointed engineer of standards, with headquarters at San Francisco, which position he was holding at the time of his recent appointment.

Luther L. Lowe, roadmaster on the White River division of the Missouri Pacific, with headquarters at Batesville, Ark., has been appointed superintendent of the New Orleans & Lower Coast, a subsidiary of the Missouri Pacific, with headquarters at Algiers, La., to succeed **C. G. Smith,** deceased.

Mr. Lowe was born on November 17, 1895, at Independence, Mo., and was educated in the public schools of that place. Prior to entering railway service Mr. Lowe spent several years in engineering work in other branches. During 1913, he was engaged as rodman on levee construction work at Cairo, Ill., and during 1914, he was an instrumentman in the city engineer's office at the same place. From 1914 to 1922, he served as instrumentman and inspector on levee construction with the Mississipppi River Commission.

Luther L. Lowe

On October 11, 1922, Mr. Lowe entered railway service with the Missouri Pacific as a rodman on the Missouri division and on May 23, 1923, he went to the Northern Kansas division as an instrumentman, being subsequently transferred to the Louisiana division on January 24, 1924, and thence to the Eastern division on January 26, 1925. On January 1, 1927, he was promoted to assistant roadmaster on the Eastern division and in July of the same year he went to the Louisiana division as roadmaster, being transferred to the White River division on January 15, 1929. Mr. Lowe remained in this capacity until his recent promotion to superintendent, effective November 5, 1929.

Engineering

Frank H. Olmstead has been appointed chief hydrographic engineer of the Kansas City, Mexico & Orient, with headquarters at Los Angeles, Cal.

M. M. Churchill, acting division engineer of the Kamloops division of the British Columbia district of the Canadian National, with headquarters at Kamloops, B. C., has been promoted to division engineer of that division.

S. R. Hursh, division engineer on the Atlantic division of the Eastern region of the Pennsylvania, with headquarters at Camden, N. J., has been transferred to the Philadelphia Terminal division to succeed **C. E. Adams,** whose promotion to superintendent is noted elsewhere in these columns. **W. H. Anderson,** division engineer, with headquarters at Akron, Ohio, has been transferred to Camden to succeed Mr. Hursh.

E. Betts, assistant engineer of standards of the Southern Pacific, has been appointed inspection engineer, with headquarters as before at San Fran-

cisco, Cal. Mr. Betts will have charge of the inspection of new material and new equipment, in addition to other duties to which he may be assigned.

Stanley G. Phillips, supervisor on the Terminal division of the Central Railroad of New Jersey at Jersey City, has been appointed assistant division engineer of the Terminal division of the Boston & Maine, with headquarters at Boston.

N. W. Smith, general superintendent of motor service of the Pennsylvania, with headquarters at Philadelphia, Pa., has been appointed assistant chief engineer, with the same headquarters. A sketch of Mr. Smith's career appeared on page 275 of the June, 1929, issue.

W. E. Trites, roadmaster of the Sudbury subdivision of the Capreol division of the Canadian National, with headquarters at Capreol, Ont., has been appointed acting division engineer of this division at the same place to succeed **A. H. Willett,** on leave of absence.

J. R. Higgins, assistant engineer in the valuation department of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has been promoted to valuation engineer of the Western lines of this road, with the same headquarters, to succeed **Ernest S. Mudge,** whose death was reported in the September issue.

H. M. Long, division engineer of the Kansas City Terminal-St. Louis division of the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo., has been transferred to the Kansas division, with headquarters at Herington, Kan., to succeed **C. C. Cunningham,** whose promotion to trainmaster is noted elsewhere in these columns. **J. T. Fitzgerald** replaces Mr. Long at Kansas City.

G. K. Farner, division engineer of the Racine and Southwestern division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Beloit, Wis., has been transferred to the La Crosse division with headquarters at Portage, Wis., succeeding **F. R. King,** resigned. **Cornelius Holland** has been appointed division engineer at Beloit to succeed Mr. Farner. Mr. Holland was born on November 25, 1889, at Diamond Lake, Mich., and graduated from the Michigan College of Mines, Houghton, Mich., in 1913. He entered railway service as computer in the engineering department of the Chicago, Milwaukee, St. Paul & Pacific on June 8, 1923, and a year later was promoted to instrumentman. On September 1, 1928, Mr. Holland was promoted to assistant engineer, which position he was holding at the time of his recent promotion to division engineer, effective November 15.

L. M. Harsha, roadmaster on the St. Louis-San Francisco, with headquarters at Fort Smith, Ark., who has been appointed assistant engineer with headquarters at Sapulpa, Okla., was born on July 9, 1890, at Shawneetown, Ill., and graduated from the University of Kansas in 1914. He entered railway service in July of the same year as a roadman on the Frisco, being promoted to instrumentman in August, 1915, and to assistant engineer in December, 1917. Mr. Harsha served in the 210th Engineers of the United States army from July, 1918, to February, 1919, and on the latter date he returned to the Frisco as a rail inspector and instrumentman, serving in this capacity until March, 1920, when he was promoted to assistant engineer. In April, 1921, he became a draftsman, and in December, 1926, he was further promoted to roadmaster, which position he was holding at the time of his recent promotion to assistant engineer.

Paul Sterling, whose promotion to assistant to the chief engineer of the New York, New Haven & Hartford was noted in the December issue, was born at Bridgeport, Conn., on March 24, 1870. He graduated from the Sheffield Scientific School, Yale University, 1892, and entered the employ of the New Haven as a rodman the following year. He has remained continually in

Paul Sterling

the service of this company. He served for a time as transitman and assistant engineer on the four-track improvement from New Haven, Conn., to Portchester, N. Y. In 1897 he was made assistant engineer of the Berkshire and Shore Line divisions and in 1904 was transferred to the Hartford division, being promoted to assistant division engineer of the New York and New Haven divisions in 1906. Three years later he was transferred to the Midland-Boston division and in 1912 he was appointed division engineer of the Midland division, subsequently being transferred to the Highland division in 1914, and to the New York division in 1916. In 1918, he was appointed maintenance engineer of the Lines West and of the Central New England, from which position he was appointed assistant to the engineer maintenance of way on February 1, 1921, the position he was holding at the time of his recent promotion to assistant to the chief engineer.

J. M. Harper, division engineer on the Illinois Central, with headquarters at Greenville, Miss., has been transferred to Baton Rouge, La., to succeed **E. W. Brown,** whose death was reported in the December issue. **H. R. Davis,** supervisor of track at Harrison, Miss., has been promoted to division engineer at Greenville to replace Mr. Harper.

G. W. Varnum has been appointed assistant division engineer on the Coast lines of the Atchison, Topeka & Santa Fe at Needles, Cal. **R. D. Pierson** has been appointed assistant division engineer at Fresno, Cal.

Mr. Varnum was born on November 17, 1889, at Montgomery City, Mo., and graduated from Iowa State College, Ames, Iowa, in 1909, with an engineering degree. In October, 1910, Mr. Varnum entered the service of the Santa Fe as a chainman in the engineering department at San Bernardino, Cal., but left the service in September, 1917, to enlist as a private in the United States Army, where he was subsequently commissioned as a second lieutenant and assigned to duty at Camp Humphreys, Va., being commissioned a first lieutenant of engineers in September, 1918. On his discharge from the army, Mr. Varnum returned to the Santa Fe as a draftsman at Winslow, Ariz., and from June, 1922, until November, 1925, he was an assistant engineer on bridge design at Los Angeles, Cal., being on the latter date promoted to assistant engineer in the office of the district engineer at Los Angeles. He was holding this position at the time of his recent promotion to assistant division engineer, effective November 1.

W. B. Wood, assistant to the general manager of the Western region of the Pennsylvania, with headquarters at Chicago, has been appointed engineer, Baltimore improvements, at Baltimore, Md., where he will take charge of the electrification project in that city. **R. C. Miller,** superintendent of the Columbus division, with headquarters at Columbus, Ohio, has been appointed acting assistant chief engineer, with headquarters at Philadelphia, Pa.

Mr. Wood was born on September 11, 1876, at Harrisburg, Pa., and graduated from the Sheffield Scientific school at New Haven, Conn., in 1897. He began his railway career with the Pittsburgh, Cincinnati, Chicago & St. Louis (now part of the Pennsylvania) in October of the same year as a rodman in the chief engineer's office, and has been with the Pennsylvania or its subsidiaries ever since. In November, 1897, he was promoted to levelman and in September, 1899, he was further promoted to assistant engineer on the Pennsylvania. From January to June, 1901, he was division engineer on the Cincinnati & Muskegon, and on the latter date he was transferred to the Cleveland & Pittsburgh division, where he remained until July, 1903, when he was appointed superintendent of the Richmond division of the P. C. C. & St. L. From that date until April, 1914, Mr. Wood was division superintendent at various points on the Pennsylvania, and on the latter date he was

promoted to general manager of the Grand Rapids & Indiana. In March, 1920, he was promoted to general superintendent of the Illinois division, and in February, 1923, he was promoted to acting general manager of what was then the Northwestern Region. He was transferred to the New Jersey division in October, 1923, where he remained until September, 1925, from which date until about July, 1926, he was on leave of absence. On his return to active service on the latter date, Mr. Wood was appointed assistant to the general manager of the Western region, where he was in charge of bus and truck activities until his promotion to engineer of the Baltimore improvements, effective December 1.

A. Chinn, district engineer of maintenance of way of the Nebraska district and supervisor of work equipment of lines West of the Missouri river of the Chicago, Burlington & Quincy, with headquarters at Lincoln, Neb., resigned on December 1, to become chief engineer of the Chicago & Alton, with headquarters at Chicago, to succeed **R. A. Cook,** who has resigned. **E. H. Piper,** district engineer of maintenance of way of the Wyoming district of the C., B. & Q., with headquarters at Alliance, Neb., has been transferred to Lincoln to succeed Mr. Chinn, and has also been appointed supervisor of work equipment of lines West of the Missouri river.

A. Chinn

Mr. Chinn was born at Dallas, Tex., on September 26, 1894, and graduated from Virginia Polytechnic Institute in 1916. He entered railway service in the latter year as an instrumentman on the Chicago, Burlington & Quincy on track elevation at Aurora, Ill. During 1918 and '1919, he served as a second lieutenant of field artillery in the American Expeditionary Force in France and then returned to the Burlington, where he was engaged from 1919 to 1921, as an instrumentman on yard construction at LaCrosse, Wis., and Centralia, Ill. In 1922, he was promoted to assistant engineer at Aurora, where he remained until 1923, when he became division engineer and roadmaster on the Quincy, Omaha & Kansas City, at Kansas City, Mo. Mr. Chinn was transferred to the Burlington as roadmaster at Kansas City in 1925, and in the following year he was promoted to assistant engineer maintenance of way at Alliance, Neb. Early in 1927, he was promoted to district engineer maintenance of the Wyoming district, with headquarters at the same point, and later in the year he was transferred to Lincoln, Neb., and also placed in charge of work equipment, a position he held until appointed as chief engineer of the Alton on December 1.

Track

M. A. Crowley, track supervisor on the Louisville & Nashville, with headquarters at Frankfort, Ky., has retired after 39 years of service with that road.

R. A. Whittingham, assistant to the division engineer of the Maryland division of the Pennsylvania, with headquarters at Wilmington, Del., retired from service on November 1, after 40 years of service with that road.

D. C. Gough, acting roadmaster on the Kamloops division of the British Columbia district of the Canadian National, with headquarters at Kamloops, B. C., has been promoted to roadmaster with headquarters at the same place.

John Drennan, supervisor of road on the Baltimore & Ohio, with headquarters at Elyria, Ohio, retired on October 1, 1929, after 39 years of active service with that road. **Henry Wilkening** succeeds Mr. Drennan as supervisor at Elyria.

E. L. Ayles, roadmaster on the St. Louis-San Francisco, with headquarters at Hugo, Okla., has been transferred to Ft. Smith, Ark., to succeed **L. M. Harsha,** whose promotion to assistant engineer is noted elsewhere in these columns. **J. W. Johnson,** section foreman at Cameron, Okla., replaces Mr. Ayles at Hugo.

J. F. Mayne, instrumentman in the engineering department of the Missouri Pacific, with headquarters at Wynne, Ark., has been promoted to roadmaster on the White River division, with headquarters at Batesville, Ark., to succeed **L. L. Lowe,** whose promotion to superintendent is noted elsewhere in these columns.

Walter C. Smith, whose promotion to roadmaster on the Northern Pacific, with headquarters at Jamestown, N. D., was noted in the November issue, was born on October 25, 1873, at Allegan, Mich., and was educated in the grade schools at that point. He entered the service of the N. P. on May 2, 1894, as a section foreman on the Lake Superior division and has served continuously in that capacity until his recent promotion to roadmaster.

J. M. Bolding has been appointed track supervisor on the Charlotte division of the Southern, with headquarters at Toccoa, Ga., to succeed **W. F. Walker,** deceased. Mr. Bolding entered the service of the Southern on March 13, 1923, as a section laborer and was promoted to section foreman on February 18, 1925, and to assistant track supervisor on September 13, 1926. On August 29, 1929, he was further promoted to acting track supervisor, which position he was holding at the time of his promotion to supervisor on November 1, 1929.

Patrick Lavery, roadmaster on the Levis division of the Canadian National, with headquarters at Levis, Que., has retired after 50 years of active railway service. He began his railway career with the Grand Trunk (now part of the Canadian National) in June, 1877, as a trackman and since then has served as section foreman, yard foreman, extra gang foreman and roadmaster. As roadmaster, Mr. Lavery's territory included the Quebec bridge.

F. W. Artois, assistant supervisor on the Pennsylvania, with headquarters at Kittanning, Pa., has been transferred to Alliance, Ohio. **C. F. New,** assistant on the engineering corps, with headquarters at Galitzin, Pa., has been promoted to assistant supervisor at Kittanning to succeed Mr. Artois. **T. B. Williams,** supervisor, with headquarters at Chambersburg, Pa., has been transferred to Cresson, Pa., to succeed **T. H. Thomas,** who in turn has been transferred to Chambersburg. **Wayne Mills** has been appointed assistant supervisor, with headquarters at Olean, N. Y.

W. M. Jacklin, roadmaster of the Bala subdivision of the Capreol division of the Canadian National, with headquarters at Toronto, Ont., has been transferred to Capreol, Ont., to succeed **W. E. Trites,** whose promotion to acting division engineer of the Capreol division is noted elsewhere in these columns. **George C. Warner,** roadmaster of the Ruel subdivision, with headquarters at Capreol, suceeds Mr. Jacklin at Toronto. **W. Deyette** has been appointed relieving roadmaster at Capreol to replace Mr. Warner.

Louis Guinn has been appointed roadmaster on the Dubuque division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Dubuque, Ia., to succeed **T. F. Hyson,** who has been transferred. **E. O. Buffmire** has been appointed roadmaster on the La Crosse division, with headquarters at Watertown, Wis., succeeding **A. F. Carlson,** who has been transferred to the Superior division, with headquarters at Green Bay, Wis., to replace **H. F. Zimmerman,** who in turn has been transferred to the Racine and Southwestern division, with headquarters at Beloit, Wis.

T. Philpot, extra gang foreman on the Central Kansas division of the Missouri Pacific, has been promoted to roadmaster on the Southern Kansas division, with headquarters at Coffeyville, Kan., succeeding **W. C. Webster,** who has been serving as acting roadmaster since the retirement of **E. G. Masters.** Mr. Philpot was born on February 4, 1883, near Louisville, Ky., and entered railway service with the Missouri Pa-

cific on February 6, 1913, as a section laborer on the Colorado division. In December, 1915, he was promoted to section foreman on the same division and in May, 1921, he was further promoted to extra gang foreman on the Central Kansas division, where he remained until November 1, 1929, the date of his promotion to roadmaster.

Albert A. Mau, assistant roadmaster on the Chicago & North Western, with headquarters at Stambaugh, Mich., has been promoted to roadmaster, with headquarters at Marinette, Wis., to succeed **H. Rasmussen,** who has retired from active service. Mr. Mau was born on October 7, 1890, at Menominee, Mich., and attended the public schools at that place. On June 1, 1908, he entered the service of the C. & N. W. as a track laborer at Carbondale, Mich., and on October 1, 1913, he was promoted to track foreman on the Peninsula division, serving in this capacity at various points and as extra gang foreman on the same division until March 15, 1924, when he was promoted to assistant roadmaster at Stambaugh, Mich., where he remained until January 1, 1926, when he was promoted to roadmaster at Escanaba, Mich. On April 15, 1926, Mr. Mau returned to Stambaugh as assistant roadmaster and remained there until January 24, 1927, when he was appointed acting roadmaster at Marinette. On April 1, 1927, he again returned to Stambaugh as assistant roadmaster, where he was located until December 1, 1929, the date of his appointment as roadmaster at Marinette.

B. P. Brevard, assistant engineer on the Illinois Central, with headquarters at Baton, Rouge, La., has been promoted to supervisor of track with headquarters at Harriston, Miss., to succeed **H. R. Davis,** whose promotion to division engineer is noted elsewhere in these columns. **G. C. Harris,** assistant engineer in the construction department, with headquarters at Chicago, Ill., has been transferred to Baton Rouge to succeed Mr. Brevard.

Mr. Brevard was born at Huntington, Tenn., on December 15, 1892, and attended the public schools at Memphis, Tenn., and later the Mississippi Agricultural & Mechanical College. He began his railway career with the Yazoo & Mississippi Valley (now part of the Illinois Central) in 1914, as a chainman on the construction of the Lambert-Swan Lake cutoff in Mississippi. Later in the same year he was promoted to rodman on location and construction and in 1916, he was transferred to the valuation department, where he remained until 1917. In that year, Mr. Brevard was appointed instrumentman on the Memphis division of the Illinois Central, but from August, 1917, to May, 1919, he was on leave of absence and served overseas with the 105th Engineers. On the latter date he re-entered the service of the Illinois Central as an instrumentman on the Kentucky division and in May, 1921, he was transferred to the Tennessee division, where he remained until December 1, 1924, when he was promoted to resident engineer on the Edgewood cutoff. On November 1, 1925, Mr. Brevard was appointed assistant engineer on the New Orleans division, with headquarters at Baton Rouge, La., where he remained until his recent promotion to supervisor which became effective on December 1.

Bridge and Building

H. A. Waid has been appointed acting bridge and building master on the Campbellton division of the Atlantic Region of the Canadian National, with headquarters at New Carlisle, Que.

W. J. Johnston, bridge and building foreman on the Toronto Terminals of the Canadian Pacific, with headquarters at Toronto, Ont., has been appointed bridge and building master on the Schreiber division of the Algoma district with headquarters at Schreiber, Ont., to succeed **E. Patenaude,** who has been transferred to Sudbury, Ont.

G. R. Holmes, supervisor of bridges and buildings on the Colorado division of the Missouri Pacific, with headquarters at Pueblo, Colo., has been transferred to the White River division, with headquarters at Aurora, Mo., where he succeeds **H. M. Baker** who has been transferred to Poplar Bluff, Mo. **J. L. Anderson,** acting supervisor of bridges and buildings on the Southern Kansas division, with headquarters at Coffeyville, Kan., has been promoted to supervisor of bridges and buildings at Pueblo to succeed Mr. Holmes. As noted in the December issue **P. F. Gentine,** who has been on leave of absence, has resumed his duties as bridge and building supervisor at Coffeyville. **L. O. Anderson** has been promoted to assistant bridge and building supervisor on the Memphis division, with headquarters at Wynne, Ark., succeeding **J. J. LaBat,** who has been serving as acting bridge and building supervisor since the retirement of **R. L. Calhoun.**

J. L. Anderson was born on June 9, 1892, at Findlay, Ohio, and attended the public schools of that place. On January 11, 1912, he entered the employ of the Missouri Pacific at Kingman, Kan., as a section laborer, but in 1913, he was transferred to the bridge department as a carpenter helper. In 1915, he was promoted to bridge carpenter and in 1917, he was further promoted to assistant bridge foreman, which position he held until 1919, when he was appointed bridge foreman. On January 1, 1929, Mr. Anderson was promoted to acting supervisor of bridges and buildings, the position which he was holding at the time of his appointment to supervisor of bridges and buildings on November 15.

Purchases and Stores

E. R. Morganroth has been appointed purchasing agent of the Pacific Coast Railroad and the Pacific Coast Railway, with headquarters at Seattle, Wash., succeeding **W. E. Nichols,** who has retired.

Albert J. Stackpole has been appointed storekeeper of the Boston & Maine, with headquarters at Keene, N. H., succeeding **L. E. Field,** who has been assigned to special duties.

Obituary

L. M. Bates, division engineer on the Chicago & North Western, with headquarters at South Pekin, Ill., was found dead at his home in that city on December 21.

James H. Harris, engineer maintenance of way of the New York Zone of the Pennsylvania, since 1920, with headquarters at New York, died suddenly of heart disease on December 2, at his home in Elizabeth, N. J.

George H. Allen, who retired from the position of roadmaster on the London division of the Southern Ontario district of the Canadian National, with headquarters at London, Ont., in 1928, died at that place on November 15, at the age of 68 years.

David Ogle Thomas, who was for some time connected with the engineering department of the St. Louis & O'Fallon railroad, died on November 24 at the age of 53 years. Mr. Thomas was a graduate of Yale and, at the time of his death, was superintendent of the St. Clair County, Illinois, Highway department.

P. F. Brendlinger, former chief engineer of the Schuylkill Valley division of the Pennsylvania, died on December 16 at the Joseph Price Memorial Hospital in Philadelphia, at the age of 79 years. Mr. Brendlinger was also at one time connected with the engineering department of the Pittsburgh, McKeesport & Youghiogheny, later resigning from railroad work to engage in personal business.

Edmund Wragge, formerly chief engineer of the Toronto & Nipissing (now part of the Canadian National) and the Toronto, Grey & Bruce (now part of the Canadian Pacific) and general manager of the latter road, died at Toronto, Ont., on November 26, at the age of 92 years. Mr. Wragge, who was born in England, had been an engineering officer on railways in Africa and England before coming to Canada in 1869, when he was appointed chief engineer of the Toronto & Nipissing. When he left the Toronto, Grey & Bruce as its general manager in 1883, he served for the next ten years as local manager of the Grand Trunk at Toronto.

James W. Moffat, a former railway engineer in Canada, died at Toronto, Ont., on October 28, at the age of 69 years. After graduating from McGill University in 1883, he entered railway service in the engineering department of the Canadian Pacific and was engaged in the survey of that company's line through the Sudbury district and the erection of its bridges at Lachine, Que., and at Sault Ste. Marie. Later he left railway service to become a conculting engineer in the United States.

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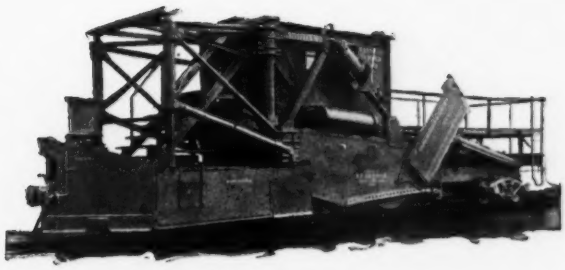

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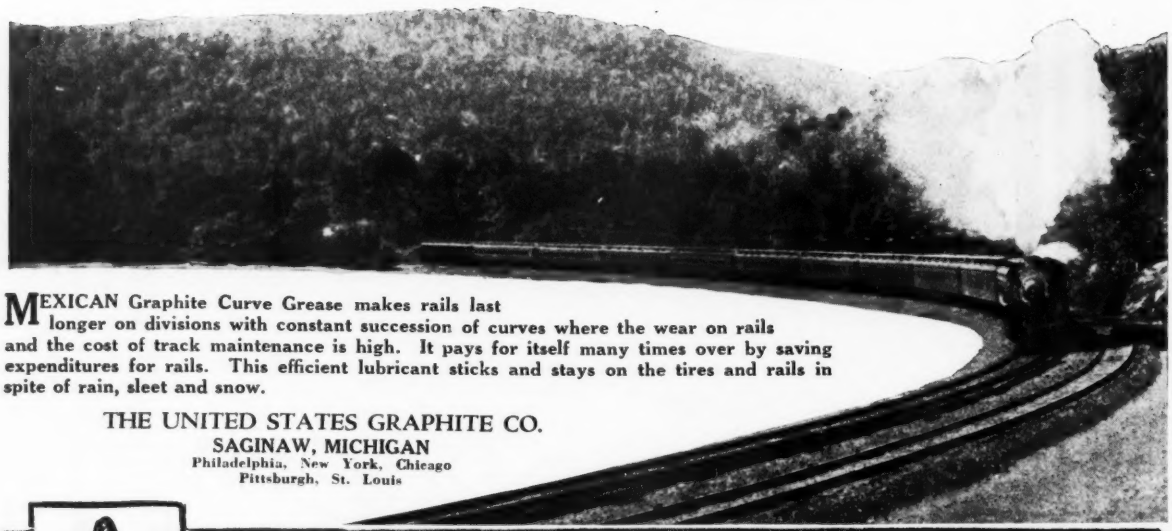

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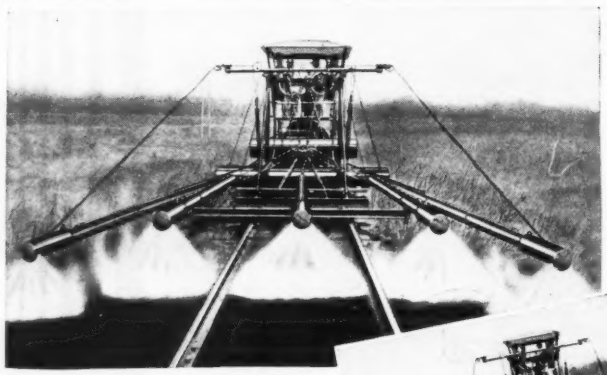

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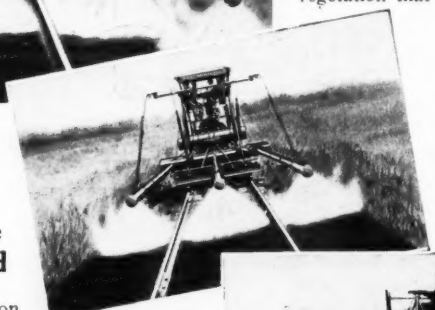

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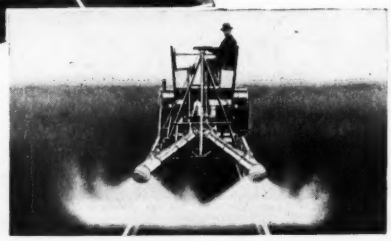

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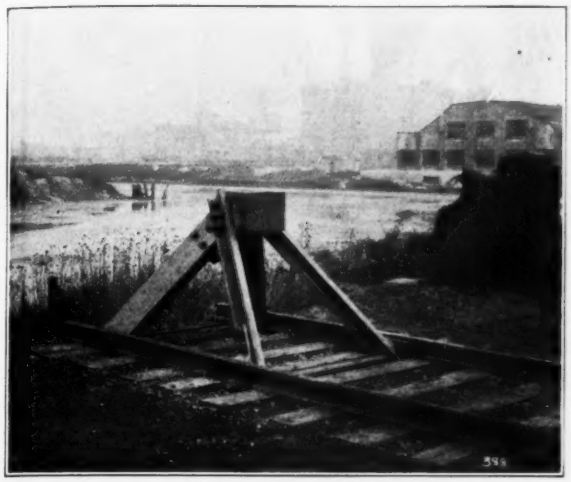

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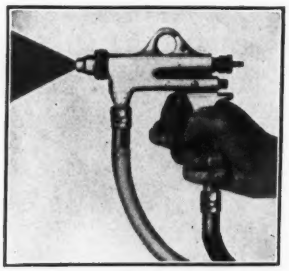

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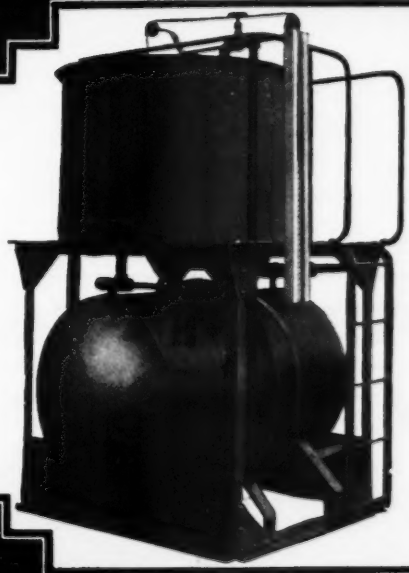

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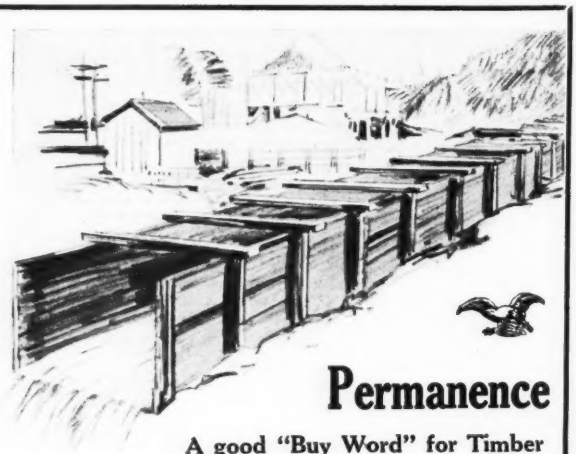

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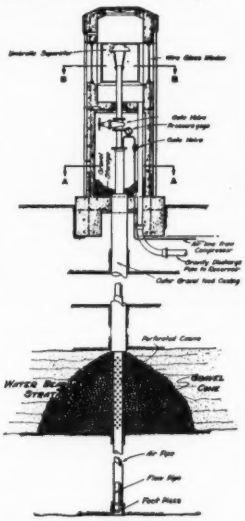

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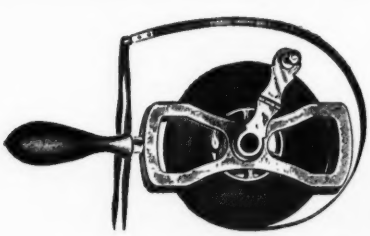

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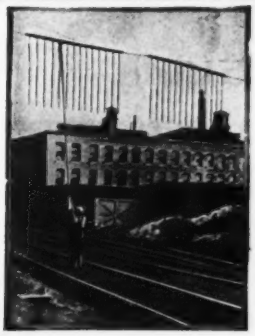

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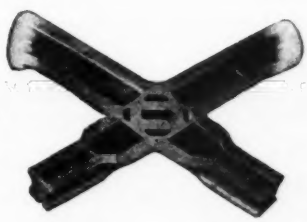

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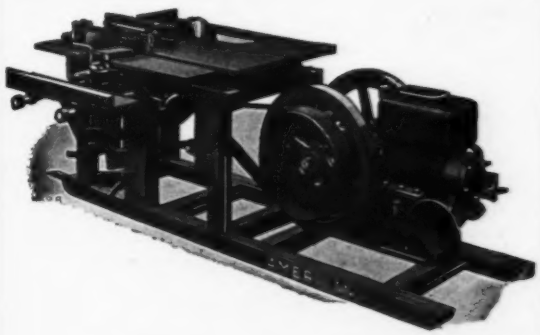

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See Dump Cars

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See Joints, Compromise

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See Timber, Creosoted

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Massey Concrete Products Corp.

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See Cranes

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See Crossings, Highway

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See Cars, Inspection

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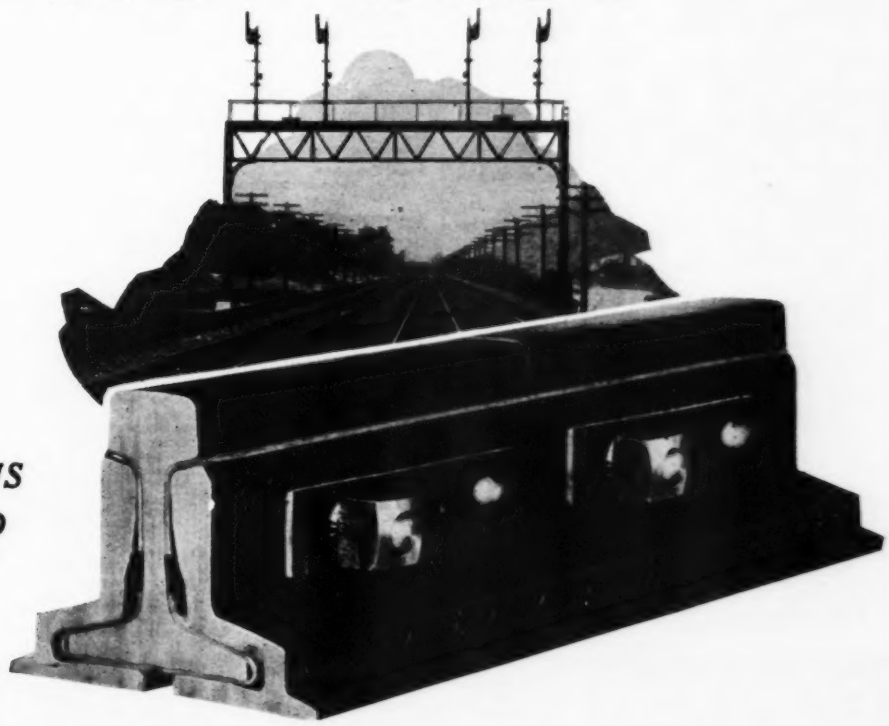

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See Bumping Posts

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See Anti-Creepers, Rail

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Rail Joints
See Joints, Rail

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See Cars, Section

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Snow Plows
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Spreader Cars
See Cars, Spreader

Spreaders, Ballast
See Ballast Spreaders

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See Joints, Step

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Tampers, Tie
See Tie Tampers

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Chicago Bridge & Iron Works.
Graver Corp.

Tanks, Roadside Delivery
Chicago Bridge & Iron Works.

Tanks, Steel
Chicago Bridge & Iron Works
Graver Corp.

Tapes, Measuring
Lufkin Rule Co.

Tee Rails
See Rails, Tee.

Telegraph Poles
See Poles

Telltales
Hastings Signal & Equipment Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Lundie Engineering Corp.

Ties
Jennison-Wright Co.
National Lumber & Creosoting Co.
Southern Wood Preserving Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Rods
Bethlehem Steel Co.
Coover Railroad Track Brace Co.

Tie Scorer
Woolery Machine Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber, Creosoted
Jennison-Wright Co.
National Lumber & Creosoting Co.
Southern Wood Preserving Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy & Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Braces
See Braces, Track

Track Cranes
Buckeye Traction Ditcher Co.
Cullen-Friestedt Co.
Nordberg Mfg. Co.

Track Drills
See Drills, Track

Track Gages
Kalamazoo Railway Supply Co.

Track Jacks
See Jacks, Track

Track Levels
Kalamazoo Railway Supply Co.

Track Liners
See Liners, Track

Track, Special Work
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Track Tools
See Tools, Track

Trestle Slabs
Massey Concrete Products Corp.

Trench Excavators, Pipe Line, Chain-and-Bucket Type, Wheel Type
Buckeye Traction Ditcher Co.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Tunnel Warnings
Hastings Signal & Equipment Co.

Undercrossings, Corrugated Iron
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Warning Devices, Bridge & Tunnel
Hastings Signal & Equipment Co.

Water Columns
Fairbanks, Morse & Co.

Water Cranes
Fairbanks, Morse & Co.

Water Softening Plants
Graver Corp.

Water Tanks
Chicago Bridge & Iron Works.
Graver Corp.

Water Treating Plants
Dearborn Chemical Co.

Water Treating Tanks
Chicago Bridge & Iron Works.

Waterproofing Fabrics
Barber Asphalt Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.

Welding & Cutting Equipment
Oxweld Railroad Service Co.

Welding, Electric
Electric Railroad Sales Corp.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Well Casings
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Wheels, Hand & Motor Car
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

Windshields
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Fairmont Railway Motors, Inc.

Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machinery Co.

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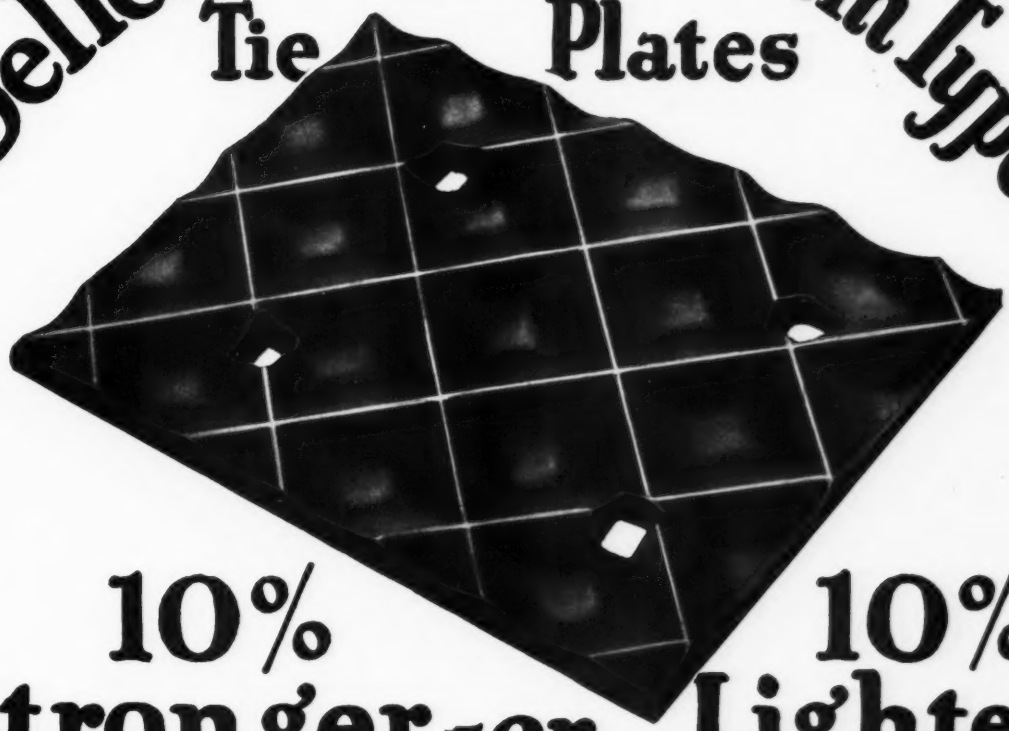

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ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILLINOIS

ALPHABETICAL INDEX TO ADVERTISERS

A

American Chain Co., Inc. ... 30
American Saw Mill Machinery Co. ... 53
Armco Culvert Mfrs. Ass'n ... 11

B

Barber Asphalt Co. ... 53
Bethlehem Steel Co. ... 10
Buckeye Traction Ditcher Co. ... 14
Bucyrus-Erie Co. ... 41

C

Calcyanide Co. ... 50
Carnegie Steel Co. ... 27
Central Foundry Co. ... 52
Chicago Bridge & Iron Works ... 21
Chicago Pneumatic Tool Co. ... 32
Chipman Chemical Engineering Co., Inc. ... 45
Cullen-Friestedt Co. ... 17
Coover Railroad Track Brace Co. ... 18

D

Dearborn Chemical Co. ... 51

E

Electric Railweld Sales Corp. ... 19
Eclipse Air Brush Co. ... 50

F

Fairbanks, Morse & Co. ... 23-24
Fairmont Railway Motors, Inc. ... 4-5
Federal Cement Tile Co. ... 42

G

Graver Corp. ... 6
General Electric Co. ... 13

H

Harnischfeger Corp. ... 28
Hastings Signal & Equipment Co. ... 53
Hunt Co., R. W. ... 50

I

Illinois Steel Co. ... 15
Industrial Brownhoist Corp. ... 25
Ingersoll-Rand Co. ... 29

J

Jennison-Wright Co. ... 31
Jordan Co., O. F. ... 47

K

Kalamazoo Railway Supply Co. ... 16

L

Lufkin Rule Co. ... 52
Lundie Engineering Corp. ... 3

M

Magor Car Corp. ... 51
Mechanical Mfg. Co. ... 49
Massey Concrete Products Corp. ... 20
Morrison Railway Supply Corp. ... 35

N

National Lead Co. ... 34
National Lock Washer Co. ... 59
Nordberg Mfg. Co. ... 12
Northwest Engineering Co. ... 7
Northwestern Motor Co. ... 8-9
National Lumber & Creosoting Co. ... 52

O

Oxweld Railroad Service Co. ... 37

P

P. & M. Co. ... 1

R

Rail Joint Co. ... 55
Ramapo Ajax Corp. ... 44
Reliance Mfg. Co. ... 2
Richards-Wilcox Mfg. Co. ... 33

S

Sellers Mfg. Co. ... 57
Sullivan Machinery Co. ... 52
Syntron Co. ... 38
Standard Sanitary Mfg. Co. ... 39
Southern Wood Preserving Co. ... 49

T

Timken Roller Bearing Co. ... 60
Toncan Culvert Mfrs. Ass'n ... 46

U

U. S. Graphite Co. ... 48
U. S. Pipe & Foundry Co. ... 22

V

Verona Tool Works ... 26

W

Wharton, Jr., & Co., Wm. ... 53
Woodings Forge & Tool Co. ... 36
Woolery Machine Co. ... 48

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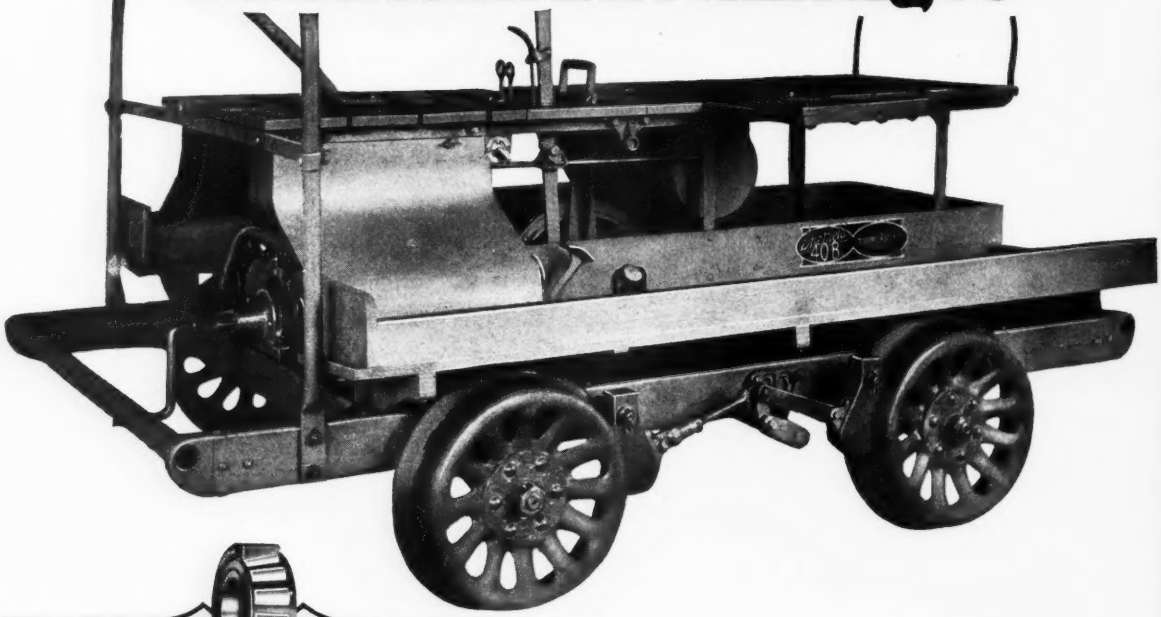

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